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MEMORANDUM REPORT ARBRL-MR-02954

THE U. S. ARMY RADCON TEAM: ORGANIZATION, CAPABILITIES AND RESOURCES

Edited by

D. L. Rigotti

September 1979

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US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
BALLISTIC RESEARCH LABORATORY
ABERDEEN PROVING GROUND, MARYLAND

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This report is intended to acquaint the reader with what the RADCON Teams are, how they operate, how they are presently constituted and their overall capabilities. Information on how the teams maintain the required readiness posture is also presented. Finally the various emergencies in which the RADCON Team has been involved over the past twenty years are described and the unique capabilities that the team possesses beyond that required by pertinent regulations are highlighted.

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1. INTRODUCTION

1.1 Background

With the advent of nuclear weapons in our military arsenal came the realization that there is a very remote but ever present possibility that an accident or incident could occur which could release radioactive material to the atmosphere. Of note is the fact that this in no way indicates the existence of a nuclear explosion but rather that during handling, movement or storage of nuclear weapons there always exists the possibility of accidents or fires which could cause the inadvertent release of radioactivity. Further, the use of radioactive materials in many aspects of research, development and production as well as research and power reactors also introduce the possibility of accidental release.

To this end, each branch of the Department of Defense maintains its own emergency teams to respond to such accidents or incidents as well as to similar requests for aid from civil agencies. The Army has several teams which can respond, depending on circumstances. Explosive Ordnance Demolition (EOD) teams must make safe any weapon or explosive and provide initial physical security of a nuclear weapon at an accident scene. Radiation Advisory Medical Teams provide medical assistance and coordinate the evacuation of any contaminated people. Alpha Teams are located at posts where weapons or other significant sources of radioactivity are stored. These teams are CBR Teams with the additional capability to monitor for alpha, beta and gamma radiation. They make an initial survey of contamination and set up an exclusion area.

In addition, two RADCON Teams have been established by the Army, who can be called to almost any accident location in the world. RADCON Teams perform detailed radiological surveys of contaminated areas and provide professional advice in control and decontamination measures at the scene of an accident or incident. This report is intended to describe in detail, what a RADCON Team is, how it is staffed and trained and how it can be deployed.

1.2 History

It is interesting to note just how the concept of RADCON Teams evolved.

During the atmospheric nuclear testing of the 1950's several safety experiments were conducted. Essentially these involved the detonation of high explosive device components under postulated accident conditions. Such experiments produced little or no fission yield, but scattered and dispersed the nuclear source material. One event variously known as

Project 57 or Task Group 57, was conducted just prior to Operation Plumbbob in 1957 at Area 13, NTS*. This experiment involved a plutonium device and resulted in a very large, highly contaminated area. This area was subsequently surveyed by military and scientific personnel, and decontamination and resuspension experiments were successfully conducted. At present, the Nevada Applied Ecology Group still conducts long term environmental studies inside a 1000 acre fenced area.

The magnitude of the problem which resulted from the Project 57 experiment proved that in the event of a non-nuclear accident (commonly called a "one-point detonation"), organized, properly trained and equipped special teams would be required by the military services possessing nuclear weapons. Therefore the Army organized two "PLUCON" (Plutonium contamination) teams in 1958, and assigned responsibility for them to the US Army Chemical Corps element at Army Chemical Center, MD (later Edgewood Arsenal and Edgewood Area-Aberdeen Proving Ground) and Dugway Proving Ground, UT. Assignment of such responsibility to the Chemical Corps was logical since members of that organization possessed extensive experience in Nuclear Weapons Effects Testing and therefore a modicum of expertise in radiological monitoring, decontamination, hazardous material handling and health physics operations already existed. With the advent of a major reorganization of the Chemical Corps which integrated it into the newly created Army Materiel Command (now DARCOM), both teams were consolidated at one location, the Nuclear Defense Laboratory (NDL) at Edgewood. Later, when the Army Nuclear Power Program was operational, the team mission was extended to include reactor emergencies and the name changed to RADCON (Radiological Control) Team. In 1970 NDL was disestablished and it's assets were assigned to the Ballistics Research Laboratory which currently maintains the responsibility for the Teams.

1.3 Authority

The authority for the Army RADCON Teams is stated in several regulations.

AR 50-5[1] required DARCOM to provide the RADCON Teams. DARCOM Supplement 2 to AR 50-5 places responsibility on the Director, Ballistics Research Laboratory, ARRADCOM to organize, train, and equip a minimum of two RADCON Teams. The DARCOM Special Assistant for Nuclear Affairs is the Point of Contact (POC) within DARCOM for control and administration of the RADCON Teams[2].

---

[1] *Nuclear and Chemical Weapons and Materiel, Nuclear Surety, AR 50-5, 1 Sep 1978, HQ, DA, Washington, DC.*

[2] *Nuclear Weapons and Materiel, Nuclear Surety, DARCOM Supplement 1 to AR 50-5, 10 Sep 1976, HQ, DARCOM, Washington, DC. This regulation is provisionally in effect, pending the staffing of an updated regulation.*

*Reference NDC TR-79 NAEG Progress Report NVO-153

DARCOM may furnish RADCON Teams on request and may authorize RADCON Team emergency assistance for radiological accidents other than those involving nuclear weapons or reactors[3]. The RADCON Teams also may contribute to a coordinated federal agency response if a peacetime radiological incident occurs[4].

1.4 Mission

The RADCON Teams are employed and trained as provided by FM 3-15[5]. The primary team function is to provide technical advice to the On-Scene Commander, who is a general officer, or to the Nuclear Accident and Incident Control Officer on all radiological aspects of the accident. The teams also perform detailed surveys for alpha and beta-gamma radiation. Further, they must be capable of supervising and providing technical advice to control and contain the radiological contamination at a site, to dispose of any radioactive wastes, and to decontaminate the site and it's associated equipment. Finally, the teams provide health physics and radiological safety services.

1.5 Operational Concept

The operational plans of the RADCON Team are detailed in a BRL SOP that is presented as Appendix A. However, most of the important features of that SOP are summarized in the following paragraphs.

If a nuclear accident occurs, the RADCON Team will be immediately placed on alert status. If required, the services of the RADCON Team will be requested by the fastest means of communication available with an IMMEDIATE precedence. Within CONUS, RADCON Teams are available by request of the OSC/NAICO to the Commander, DARCOM. RADCON Team assistance may be requested from the Army Operations Center (AOC), area code 202, 695-0441 (AUTOVON 225-0441), or through the JNACC, area code 505, 264-8279 (AUTOVON 964-8279). Direct requests may be made by message to the Director, Ballistic Research Laboratory, Aberdeen Proving Ground, MD. or by telephone to the Chief, Radiation Engineering Branch, area code 301, 671-3509 (AUTOVON 584-3509) during duty hours. After duty hours, call area code 301, 278-4500 (AUTOVON 283-4500) for the Staff Duty Officer of Aberdeen Proving Ground. Any request for assistance should include as much of the following information as available:

(1) Name, location, and telephone number of the person requesting the assistance; i.e., the OSC/NAICO.

(2) Type of accident/incident, such as weapon, reactor, other. In weapon accidents the proper code name, where applicable, should be given.

---

[3] *DARCOM Disaster Control Plan (DARCOM-DCP) 19 May 1977 with change 1, 11 July 1978.*

[4] *Interagency Radiological Assistance Plan ERDA-10.*

[5] *Nuclear Accident and Contamination Control, FM 3-15, November 1975, HQ, Department of the Army, Washington, DC.*

(3) Location of the accident site and coordinating instructions for leading the team to the control point, if required.

(4) Type of radiation (alpha, beta, or gamma), extent of area, and levels of contamination if known.

(5) Type of surface involved, such as open field, roadway, or buildings.

(6) In case of accidents involving shipments of radioactive materials, the types of radioisotopes involved, if known.

(7) Location of nearest airfield.

Upon receipt of a movement order, the RADCON Team will be enroute within 4 hours. The team will travel by air or surface transportation, whichever provides most expeditious means. If the entire team cannot be enroute within 4 hours, an advance party consisting of the team leader and one monitor (as a minimum) will be enroute within 4 hours. This advance party will carry at least one flyaway case containing alpha and beta-gamma radiacs, one Broken Arrow Response Kit, and protective gear for one day's operation. Meanwhile, the remainder of the team, under the command of the assistant team leader, will proceed as soon as possible after the advance party so as to arrive within 24 hours after receipt of movement order. Concurrent with the above actions is notification and activation of Aberdeen Proving Ground (APG) support services to include travel orders, cash advances, transportation, airline reservations/ticketing, etc. APG has been thoroughly briefed and tested on the emergency support requirements of the RADCON Team.

Upon arrival at the accident site, the team leader will report to the OSC/NAICO for instructions. If not already accomplished by the Alpha Team, the RADCON Team will determine the degree and extent of radiological contamination. Supervision of decontamination and cleanup may also be a responsibility of the RADCON Team should the OSC/NAICO require such effort.

In order to maintain maximum responsiveness, the RADCON Team has ensured that <u>all</u> instrumentation (discussed in detail in a later section), supplies, and ancillary equipment be made mobile by air, land, and if need be, sea. Thus, proper packaging has been developed for all items so as to sustain the RADCON Team technically in a self-sufficient manner in almost any environment.

2. REQUIRED RADCON TEAM CONSTITUTION AND CAPABILITIES

The required RADCON Team constitution and capabilities is specified in the Department of the Army Field Manual FM 3-15, Nuclear Accident and Contamination Control, November 1975. The following paragraphs summarize the essential elements of the team constitution and capabilities as delineated in that document.

2.1 Team Composition

The composition of the RADCON Team is designed for the accomplishment of the specific mission outlined in the preceding section. The team will consist of a minimum of a team leader, a qualified health physicist, and seven additional individuals who have particular specialties and skills. These include the following:

- Team Leader
- Health Physicist
- Laboratory Specialist
- Equipment Specialist
- Decontamination Specialist
- Radiation Monitors (2)

The Team Leader should be a Nuclear Effects Engineer or an equally qualified civilian. He must have a detailed knowledge of nuclear weapon accident potentials and the associated hazards. He should be qualified in radiological safety and nuclear emergency team operations. The Team Leader will coordinate the activities of the RADCON Team with other emergency teams and the On Scene Commander (OSC) at the accident site. He is responsible for the training and readiness of the team at all times, to include supervising the members when engaged in team support activities. He should keep abreast of the latest developments in military and commercial radiacmeters and other equipment. The Team Leader, together with a medical representative, will certify that the contamination has been reduced to an acceptable level for release of the area after operations have been completed.

The Health Physicist must be trained in the protection of personnel from the hazardous effects of radiation. He must have a knowledge of shielding requirements, dose calculations, maximum permissible limits of exposure, and sampling and evaluation techniques for air, water, and ground contamination. He will provide all dosimetry services for the team and other personnel as directed by the Team Leader. He will maintain complete exposure records as outlined in AR 40-14 and Title 10, Code of Federal Regulations, Parts 19 and 20. The Health Physicist will advise the Team Leader on health physics matters and interpretation of the data obtained.

The Laboratory Specialist must be trained in radiochemistry laboratory procedures and techniques and qualified to perform radiological laboratory analyses of samples, to include quantitative alpha determinations. He must be qualified to obtain air, water, and surface samples and to evaluate the data obtained. He will maintain all necessary laboratory data and records related to samples and analyses. In addition, he will be capable of acting as assistant to the Health Physicist when directed by the Team Leader.

The Equipment Specialist will be qualified to operate, check, calibrate and make limited field repairs on all types of radiacmeters

and air samplers used by the team. His functions will be to store, control, issue, and maintain all of the electronic equipment in possession of the team at the accident site. Further, he will check the functions of the radiac equipment in accordance with TM-38-750, TB 43-180, and other pertinent publications. In addition, the Equipment Specialist will maintain two complete flyaway kits ready to move at all times.

The Decontamination Specialist will be qualified to advise the Team Leader on all aspects of radiological decontamination of personnel, equipment, facilities, and large areas. He will have a working knowledge of shielding requirements, waste disposal procedures, and shipping requirements for radioactive waste. He will supervise the establishment and operation of the personnel and equipment decontamination stations.

The two Monitors will be qualified to perform survey and monitoring, to install and operate air samplers, to take other samples as required, and to assist in the monitoring duties at the contamination control station. In addition, they will be proficient in decontamination procedures and will assist the Decontamination Specialist when directed by the Team Leader.

2.2 Equipment

Table 2.1 is a list of the minimum quantities of equipment recommended by FM 3-15 to accomplish the assigned mission of the RADCON Team. For extended operations, the team will require additional support. The OSC will request this support from the nearest military installation. The request may include, but is not limited to, messing facilities, quartering facilities, lighting equipment, power generators, engineer equipment, communication equipment, and additional personnel. The equipment list should be kept as small as possible consistent with accomplishment of the mission. The team must maintain a high degree of mobility so that it may be responsive to any radiological emergency.

In addition to those specifications listed in Table 2.1, FM 3-15 also suggests quantities of various items in the following categories: electronic repair equipment, marking equipment, decontamination equipment, protective equipment, individual equipment, administrative supplies, and miscellaneous equipment.

2.3 Training

FM 3-15 states that all members must be trained in alpha and beta-gamma monitoring and in sampling techniques to include air sampling. Also, training to qualify individual team members in the assigned functions will be conducted periodically to insure proficiency. Each member of the team should be cross-trained in an alternate position whenever possible. Some recommended formal training courses include Nuclear Emergency Team Operations, Nuclear Hazards Training Course, and Radiological Safety.

Table 2.1. Suggested Equipment for RADCON Team

Item	Quantity
A. Detection and Identification Equipment	
Radiac Set: AN/PDR-60 (Figure 2.1)	4
Radiac Set: AN/PDR-27 (Figure 2.2)	4
Radiacmeter: IM-174A/PD	4
Tritium monitor (Figure 2.3)	1
Air Sampler (Figure 2.4)	4
Tripods for air samplers	4
Gamma Radiacmeter (Figure 2.2)	2
Flyaway kit (Figure 2.5)	2
Scintillation alpha counter	1
Millipore filter counter (Figure 2.6)	1
Analyzer, multichannel (Figure 2.7)	1
Anemometer, ML-433A/PM	1
Calibrator, radiac, AN/UDM-6	1
B. Dosimetry and Health Physics Equipment	
Radiacmeter: IM-9/PD	2 pm[a]
Radiacmeter: IM-147/PD	8 pt 2 pm
Radiacmeter: IM-93A/UD	1 pm
Pocket dosimeter (0-5 rad), self-indicating	30 pt
Charger, radiac detector, PP-1578A/PD	2 pt
Film badge (beta-gamma)	2 pm
Film badge (neutron)	1 pm
Nose and surface swipe kit	1
Soil sampling kit	1
Polyethylene bottle, 1 liter	50
C. Communication Equipment	
Radio set: AN/PRC-77	1
Receiver set, radio: AN/PRR-9	4
Transmitter set, radio: AN/PRT-4	4

a - pm, per member; pt - per team

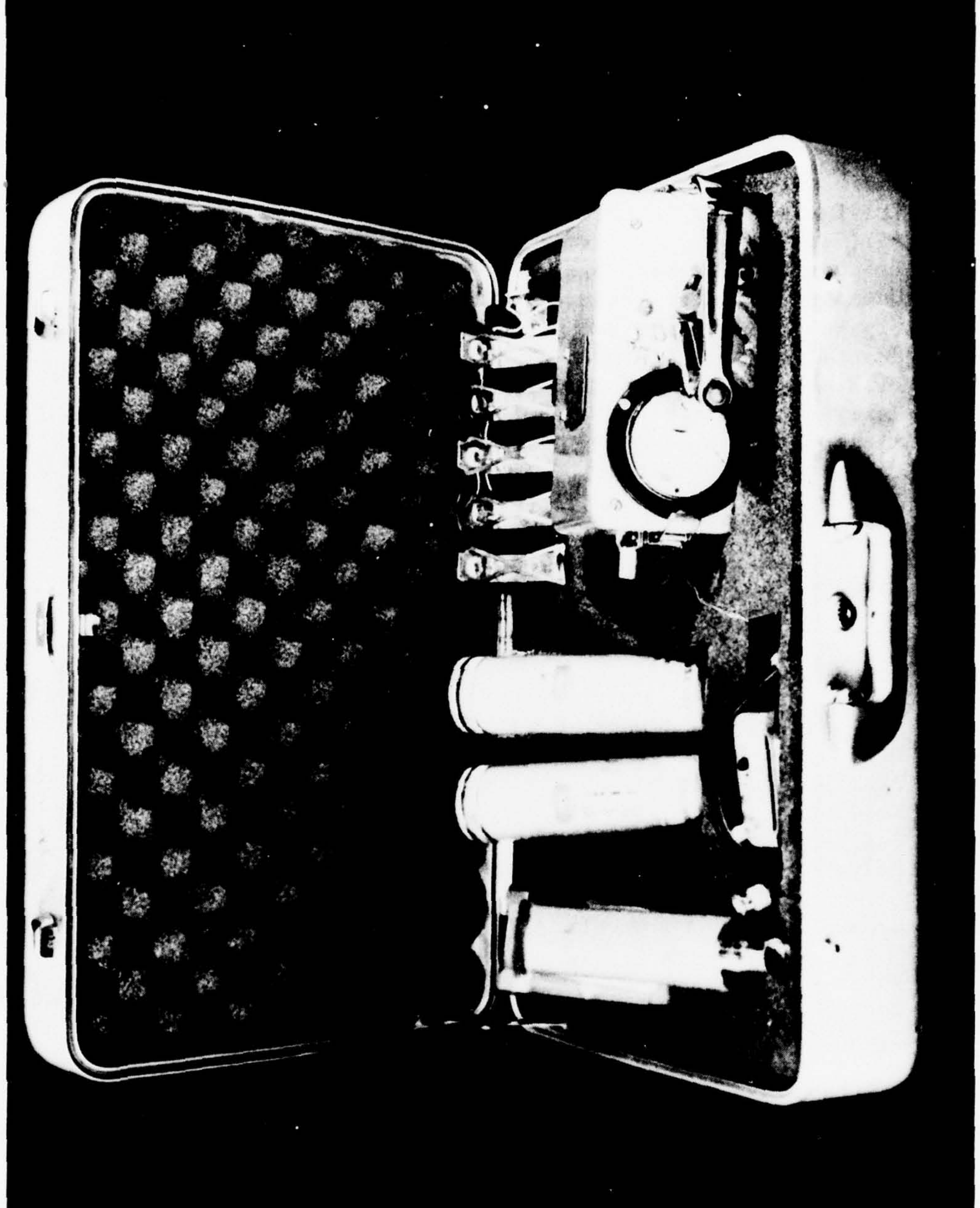

Figure 2.1. Radiac Set: AN/PDR-60

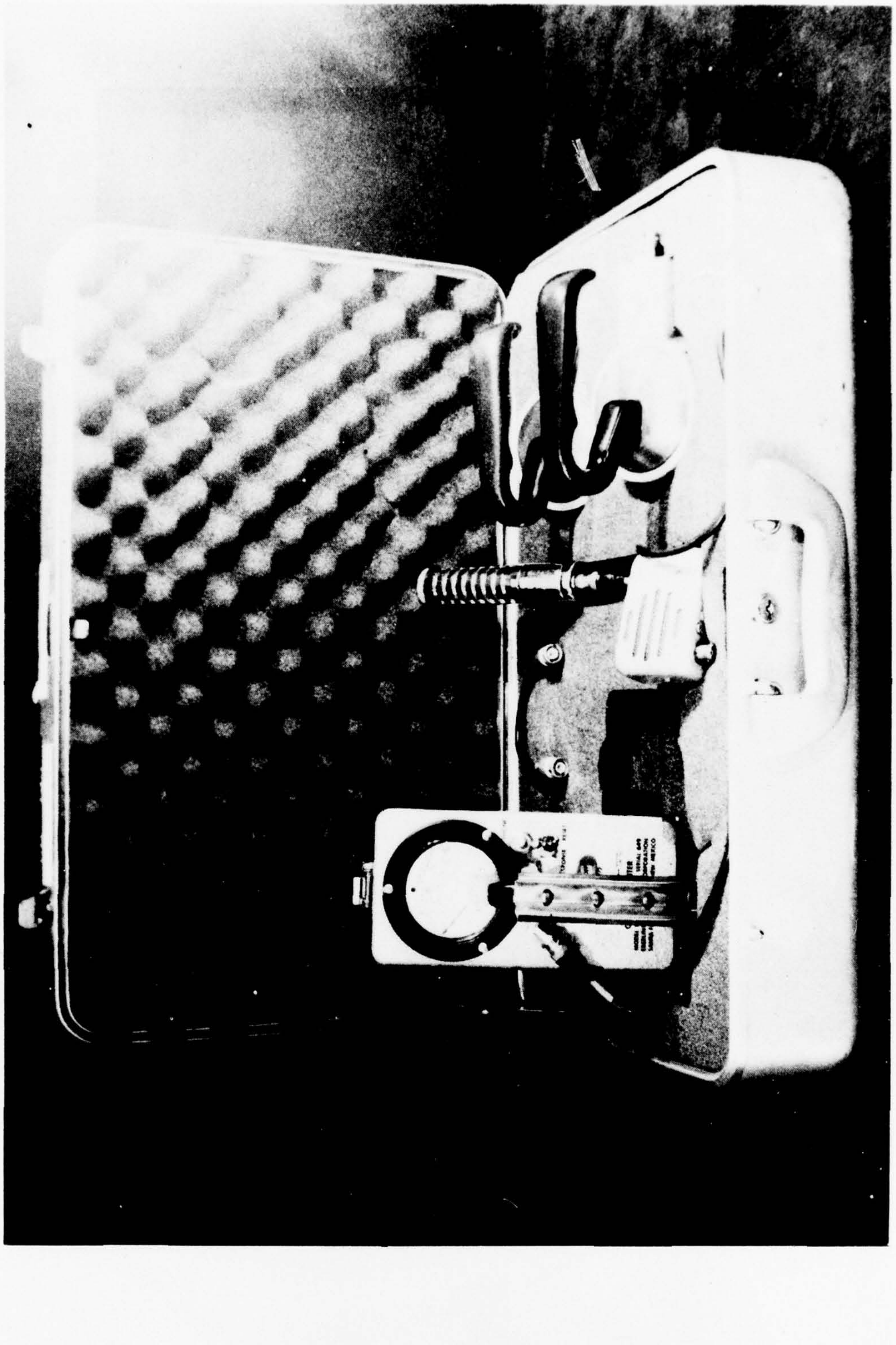

Figure 2.2. Radiac Set: AN/PDR-27

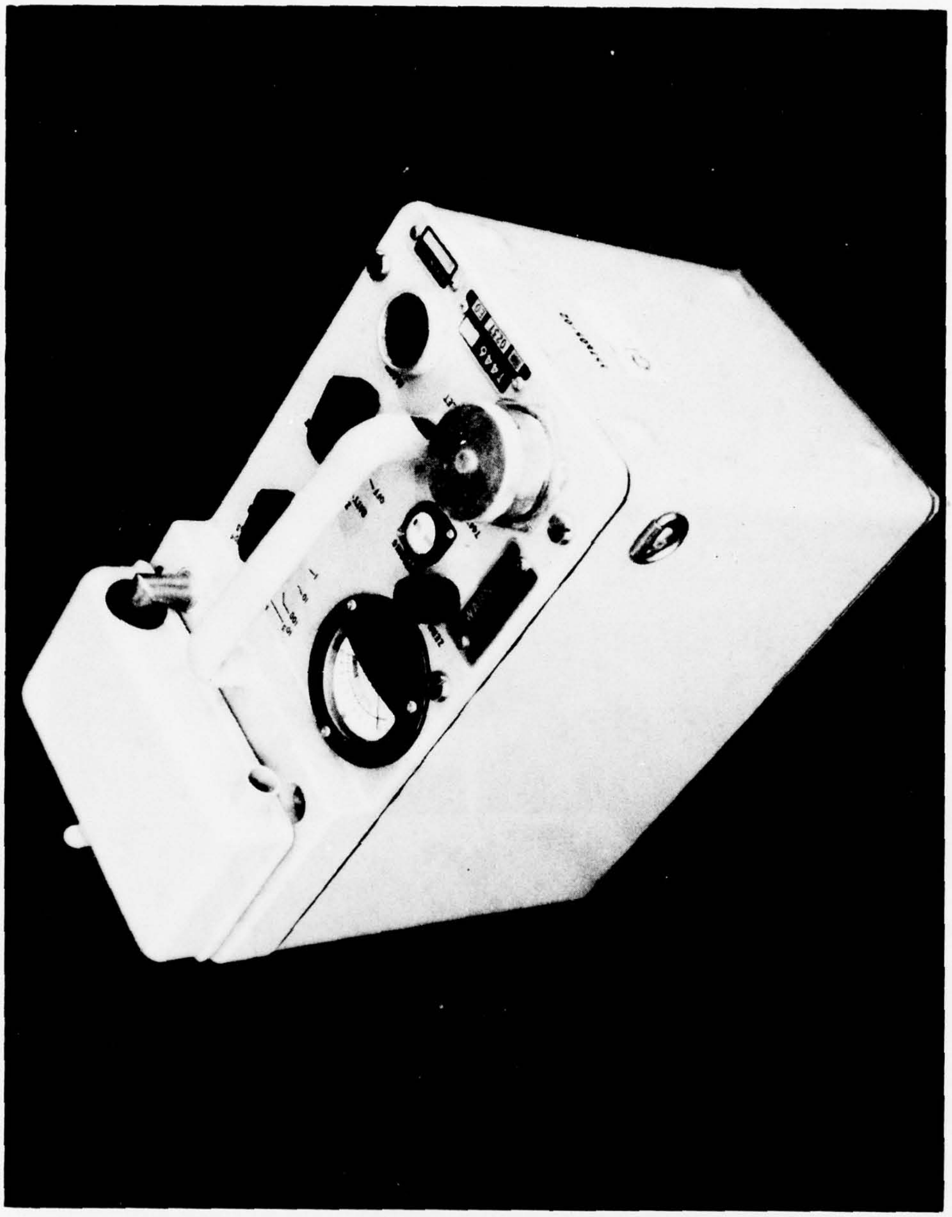

Figure 2.3. Tritium Monitor

Figure 2.4 Air Sampler

Figure 2.5. Flyaway Kit

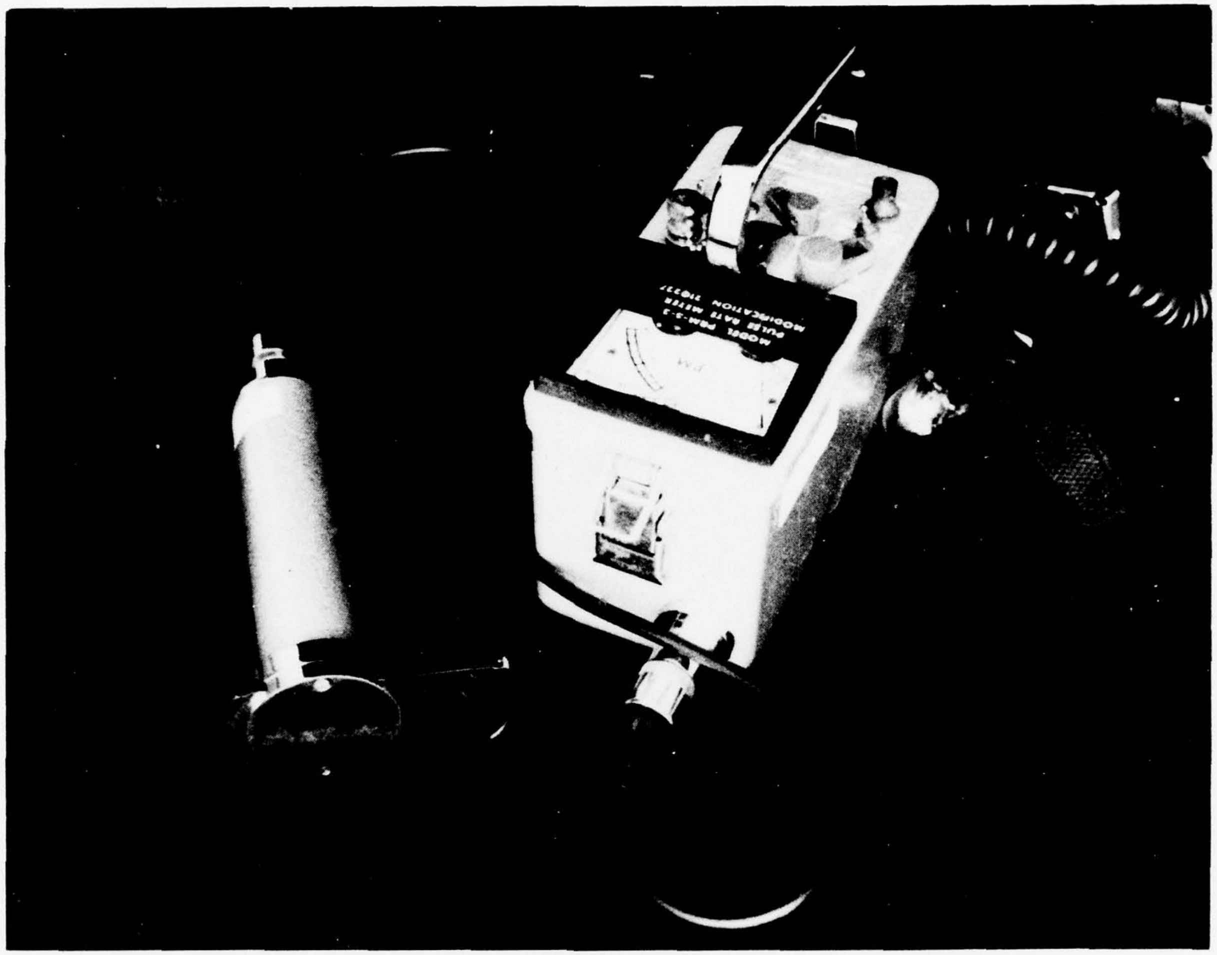

Figure 2.6. Millipore Filter Counter

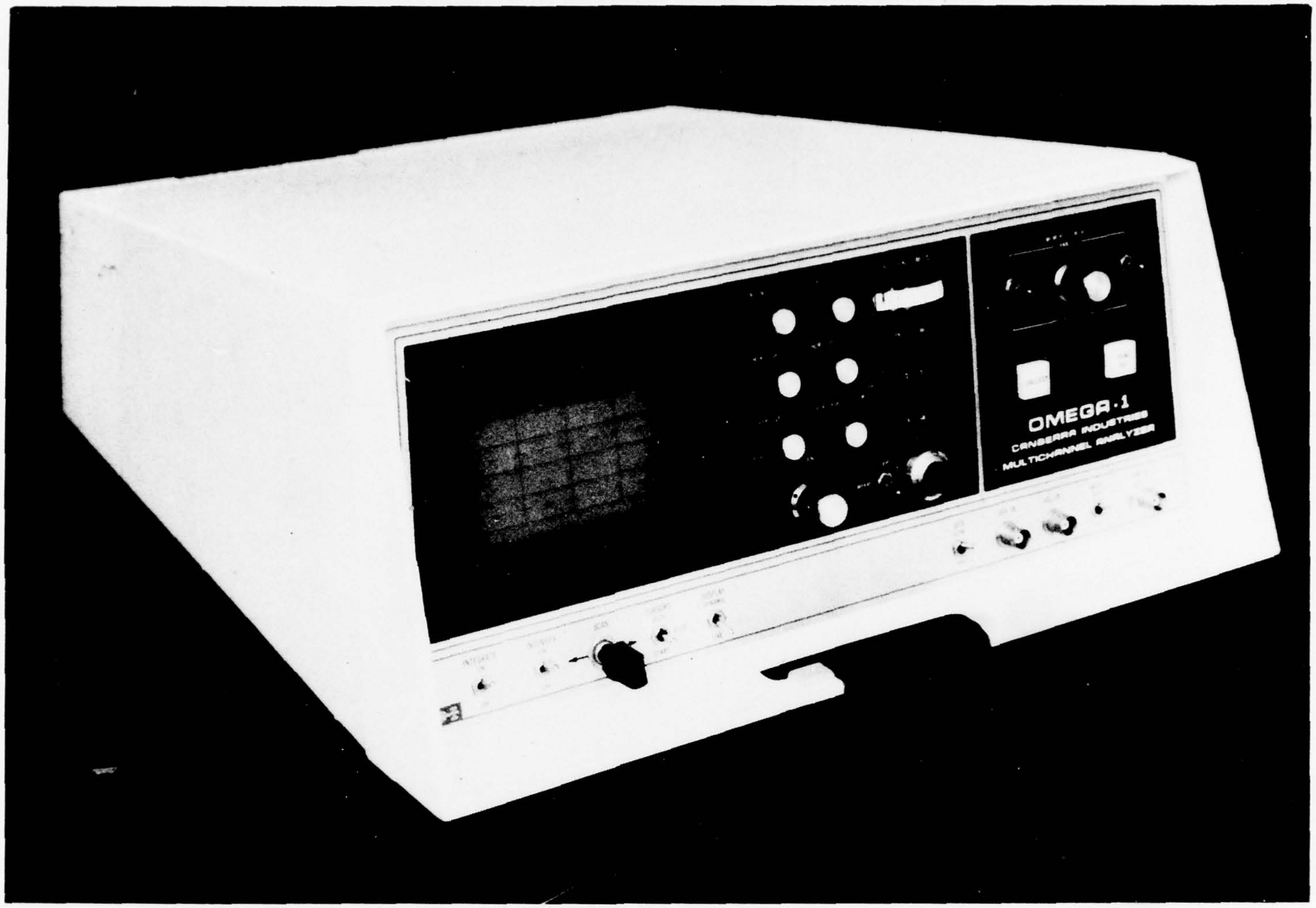

Figure 2.7. Analyzer, Multichannel

In addition to the recommended formal training, periodic test alerts are required to determine that individuals are adequately trained in all operational phases.

2.4 Utilization

If a nuclear accident occurs, a RADCON Team will be immediately placed on alert status. If required, the services of a RADCON Team will be requested by the fastest means of communication available with an immediate precedence (see Appendix A for communication channels).

Upon receipt of a movement order, the RADCON Team will be enroute within 4 hours. The team will travel by air or surface transportation, whichever provides the most expeditious means. If the entire team cannot be enroute within 4 hours, an advance party consisting of a minimum of the team leader and a health physicist and one monitor will be enroute within 4 hours. The remainder of the team, under the command of the assistant team leader, will proceed as soon as possible after the advance party, so as to arrive within 24 hours after receipt of the movement order.

Upon arrival at the accident site, the team leader will report to the OSC for instructions. If not already accomplished by the Alpha team, the RADCON Team will determine the degree and extent of radiological contamination. The RADCON Team will secure the names of all individuals and ascertain the identification of any animals involved in the accident and determine their present location. Decontamination of personnel, animals, and equipment will be accomplished within physical limitations. Cleanup and contamination control measures taken by augmentation personnel with equipment obtained from adjacent military installations will be supervised by the RADCON Team. The Alpha team can provide additional specialist assistance if requested.

3. OPERATIONAL READINESS

As stated in the two previous chapters the RADCON Team maintains the capability to repond to requests for assistance in very short periods of time. All instrumentation must be maintained in a state of readiness, and supplies are kept at operational levels. It has been found, through experience, that team readiness is very dependent on a number of other factors such as continuous training of personnel. To this end, all personnel attend monthly training meetings and special courses as required. This section of the report describes in detail some of these operational procedures that contribute to the team's readiness.

3.1 Training

Each year, a training plan is developed for the RADCON Team. This plan usually involves monthly or bi-monthly training sessions. Both

lecture type instructions and laboratory exercises are included in the plan. In addition, a full scale field exercise must be planned and conducted each year. During the training sessions, Team personnel are instructed concerning new instrumentation and procedures; reviews of established instrumentation and processes are conducted and new procedures are developed jointly by the team members as required. In recent years, the yearly field training exercise has been conducted at the Nevada Test Site where facilities are available for actual field monitoring of Pu contaminated areas thus offering invaluable experience to the team members.

In addition to the monthly training sessions and the yearly field exercise, all team members recently attended a 34 hour course of instruction in Radiological safety procedures given by personnel of the USAOCC&S.* This course was a special adaptation of their 7K-F3 Radiological Safety Course.

3.2 Equipment and Supplies

The instrumentation required by FM 3-15 has been acquired and is included in the RADCON Team (RT) inventory. However, with the inclusion of incidents/accidents involving reactors and other radioactive materials it has been found that additional instrumentation is required. Such instrumentation has also been acquired and is included in the inventory listing attached as Appendix B. Further a larger array of supplies necessary for field operations have also been obtained. These are also listed in the inventory.

3.3 Equipment Maintenance and Calibration

All of the RADCON portable survey instruments are maintained and calibrated under a contract with Eberline Instrument Corp., Sante Fe, NM. Each instrument is sent to the contractor's facility quarterly for maintenence and calibration. When the instruments are returned to the RT, a complete operational check is performed prior to the instruments being placed in a ready-for-use status. In addition, the contractor is required to provide the following in writing: (a) Statements of NBS traceability of all radiation sources used for instrument calibration to include source type, strength, certification frequency, method of certifying to NBS (i.e., ion chamber, etc,), and statement of in-house record keeping policy regarding traceability, (b) A brief narrative describing the radiation exposure geometry used with each instrument being calibrated, (c) Statement of NBS traceability of the precision pulser(s) used for electronic certification of all instruments to include frequency and method of certification. Further, calibration certificates must be supplied showing a quantitative radiation level reading compared to a known calibration point value for the PIC-6A, E-500B, E-520, and PAC-1 SAGA instruments. The HP-210 probes must be certified operational to manufacturers original specifications. The PRM-5-3 instruments have to be electronically certified using a precision pulser.

*U.S. Army Ordnance Chemical Center and School.

Specialized RT laboratory instrumentation such as the liquid scintillation counter, multi-channel spectrum analyzer system, etc., are serviced and maintained on a "as-required basis" by manufacturer service contract. Portable survey instrumentation spare parts, manuals, test equipment and tools are stocked (in-depth) to support short-term ($\sim$2 weeks) field missions. Field repair of survey instrumentation is performed by two electronic specialists assigned to the team.

3.4 Resupply Operations and Personnel Readiness

With the large variety of supplies and equipment necessary to ensure team readiness, it has become a major bookkeeping problem to ensure that an appropriate inventory is available. Further, due to personnel turnover, a number of administrative problems have been incurred. These include maintaining records of security clearances (Top Secret and CNWDI are required); ensurance that OCONUS operations can be conducted by having up-to-date passports, shot records, etc.; that appropriate members of personnel have drivers licenses for military vehicles, etc. To enable a minimum expenditure of time for such record keeping, several computer programs have been written and are employed. For example, all supply and personnel data are maintained in an automatic file system on the BRL computer. An access program enables the computer operator to list pertinent information about RADCON Team supplies, expiration dates, or action dates. Various commands are available to manipulate the files. The commands and a brief description of each are as follows:

ACTION	- identifies personnel personal items to be updated, i.e, shots, drivers license, passport, etc.
LIST	- lists all personnel data, such as name, phone number, address, date of birth, shot expiration dates, etc.
EXPIRATION	- (subset of LIST) lists only: name; expiration dates of passport, drivers license (military), tetanus shot, typhoid shot, small pox shot, and yellow fever shot; blood type; and indicates if the person has a CD card and an ID tag.
SECURITY	- (subset of LIST) lists only: name, social security number, date of birth, place of birth, and if a U.S. citizen.
HOME	- (subset of LIST) lists only: name, home phone number, and address.
WORK	- (subset of LIST) lists only: name, work phone number, and local working address.
CALIBRATION	- lists instrument group due for calibration and date; also indicates if batteries are to be replaced and reordered.
MONTHLY	- list items whose operation are to be verified such as the communications radio, electric generator, etc.
DOSIMETER	- lists dosimeters as to serial number, model number, range, and status.

REORDER	- identifies items (expendable items) with known shelf life to be reordered this month.
CUTOFF	- identifies that the following data will be the cutoff date for information to be processed, otherwise the first day of the current month is used. The cutoff date is in the format 3I2 with month-day-year (i.e., 072179 for 21 July 1979).
INVENTORY	- lists total inventory.
INSTRUMENTS	- lists all RADCON instruments that are stored in suit case.
GP1	- (subset of INSTRUMENTS) lists instruments associated with group 1.
GP2	- same as GP1, but for group 2.
I1,...., I*n*	- itemize contents of instrument case I1, I2,...., I*n*. For each listing a separate card must be used. For a total listing use the INVENTORY card; for a partial listing use the GP1 or GP2 card. Currently *n*=22.
AIR, AS1, AS2, AS3	- Same as I1,....,I*n* but for air sampler cases. Currently only three cases.
SUIT, SO, S1, S2	- Same as I1,....,I*n* but for suit cases not associated with radiac instrumentation. Currently, only three suit cases.
FOOT, F1, F2	- Same as I1,....,I*n* but for survey footlockers. Currently only two footlockers.
ALL	- Automatically execute. 1. ACTION 2. DOSIMETER 3. MONTHLY 4. CALIBRATION 5. REORDER 6. INVENTORY
END	- end execution of RADCON Program.

RADCON Team Personnel Personal Data Deck

Corrections to RADCON personnel personal data can be made by making appropriate changes to the personnel data file and executing the RADCON PROGRAM with the ACTION command, LIST command or any of its subset commands (EXPIRATION, HOME, WORK, or SECURITY). There are four records in the personnel file per individual in sequence.

Record #1 HOME PHONE & ADDRESS

FORMAT (13A6, 2A)

Columns 1-24 (left justify-LJ)	NAME	last, first, middle initial SMITH, JOHN W. (LJ)
Columns 25-36 (right justify-RJ)	HOME PHONE NUMBER	area code, number 301 671-3551 (RJ)
Columns 37-78	HOME ADDRESS	house number and street (LJ) town (RJ to 69) comma "," (70) state (71-72) blank (73) zip code (74-78)

Record #2 SECURITY

FORMAT (12X, 2A6, 3A2, 3A6, 3A3, 4A2, 15X)

Columns 1-12 Blank, may insert name for identification purposes

Columns 13-24	SOCIAL SECURITY NUMBER	123-45-6789 (RJ)
Columns 25-30	DATE OF BIRTH	051743 (May, 17, 1943) month (25-26 RJ) day (27-38 RJ) year (29-30 RJ)
Columns 31-48	PLACE OF BIRTH	town "," (31 LJ) state (47-48)
Columns 49-51	U.S. CITIZENSHIP	YES or NO (RJ)
Columns 55-57	CIVIL DEFENSE CARD	YES, NO, N/A (RJ)
Columns 55-57	ID TAGS (DOG TAGS)	YES or NO (RJ)
Columns 58-59	BLOOD TYPE	A+

Record #3 WORK PHONE & ADDRESS

FORMAT (12X, 8A6, 7A2)

Columns 1-12 Blank, may insert name for identification purposes

Columns 13-24 PHONE NUMBER 671-3551 (RJ)

Columns 25-56 WORK ADDRESS laboratory, division, branch
address (25 LJ)
room number (RJ)

Record #4 EXPIRATION DATES

FORMAT (12X, 20I2)

Columns 1-12 Blank, may insert name for identification purposes

Columns 13-48	EXPIRATION DATES	passport	(13-18)
		tetanus shot	(19-24)
		typhoid shot	(25-30)
		small pox	(31-36)
		yellow fever	(37-42)
		drivers license	(43-48)

Note: Dates are entered by month, day year (i.e., 051743 for 17 May 1943). Expiration dates for the shots are really the day that the shot was given. The computer calculates the actual expiration dates based on a 3 year safe period for typhoid and small pox, and a 10 year safe period for tetanus and yellow fever.

RADCON Dosimeter Data Deck

The dosimeter data file contains a listing of the dosimeters used by the RADCON Team. Each record contains entries for three dosimeters, and each dosimeter has three entries each. The record format is (3(3A6, 6X)).

Columns 1-6 (25-30), (49-54)	RANGE	0-0.2	(RJ)
Columns 7-18 (31-42), (55-66)	SERIAL NUMBER	12345678	(RJ)
Columns 19-24 (43-48, (67-72)	MODEL NUMBER	865	(RJ)

Note: To identify a defective dosimeter, type an * in the RANGE entry left justified (column 1, 25, or 49).

Inventory Program Update

The inventory files are on MASS STORAGE files using RADCON ACCESS subroutines. Currently, there are 31 subfiles: I1 through I23, S0 through S2, AS1 through AS3, and F1 and F2.

The first record of each subfield contains the name identifier (I1, S3, A2, F2) and the number of records in that field; format is (A6, I6) right justified.

4. SUPPLEMENTAL CAPABILITIES

4.1 General

Experience gained through years of experimental programs fielded at nuclear weapons test sites, frequently remote in terms of support facilities, has reinforced a belief in being programatically self-supporting. To this end the US Army RADCON Teams have developed supplemental capabilities to facilitate expedient and thorough performance of its assigned mission through implementation of needed flexibilities beyond those currently required by Field Manual 3-15 (see Section II).

Sophisticated analysis techniques and equipment are included in these supplemental capabilities to address any or all accident contingencies. A base of operation includes a semi-trailer containing a computer based multi-channel analyzer, a liquid scintillation counting system, a low-beta counter, and a full complement of support supplies for sustained field operations. These facilities are discussed in the following paragraphs.

4.2 RADCON Trailer

The RADCON trailer contains essential supplies and equipment for sustained operations in the field. It is a 30 foot semi-trailer that is readily transportable and contains its own environmental control system. Power requirement for the trailer is 120-208 V, 3-phase, 4 wire, 100 Amp service.

The trailer is transportable and contains the following laboratory instrumentation:

1. Liquid Scintillation Counter Searle Analytic, Delta 300 Model 6890.
2. Multichannel Analyzer Canberra, Model 8100 (Figure 4.1) with a PDP 11/05 computer-processor with Teletype Terminal.
3. Low Background Counter Tennelec LB 1000 Series (Figure 4.2).
4. Computer data-link terminal (Figure 4.3).
5. Portable Alpha Counter (Figure 4.4).
6. Portable Beta Counter (Figure 4.5).

In addition, the trailer also contains a complete electronics workbench, file cabinets, desk, refrigerator, and six general purpose storage cabinets. The typical storage inventory includes:

- 20 sets of radiac gear (coveralls, gloves, hood, boots, etc.) and M-17 protective masks.
- Decontamination supplies.

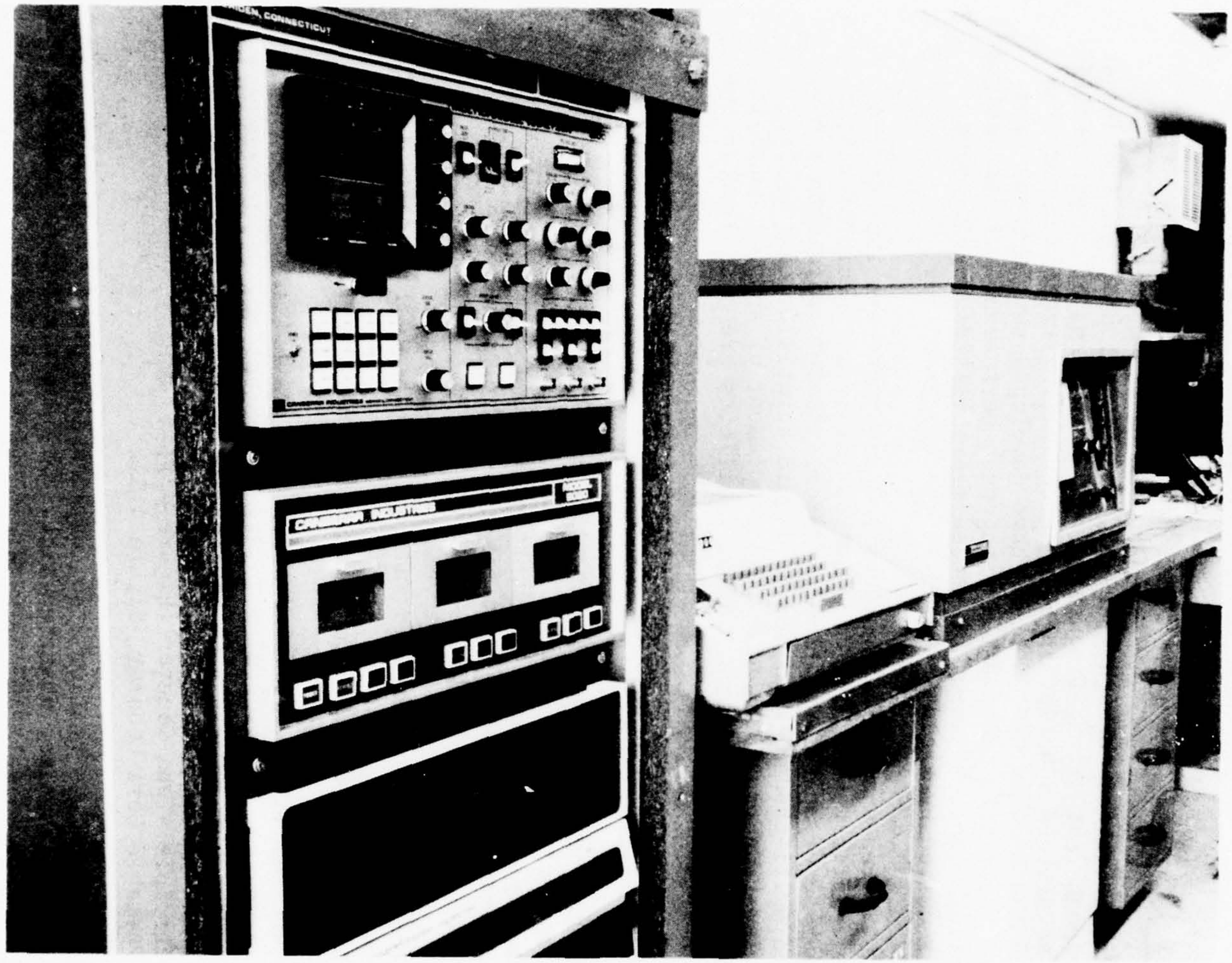

Figure 4.1. Multichannel Analyzer With Computer-Processor And Teletype Terminal
(Note: The liquid scintillation counter is adjacent to the teletype terminal).

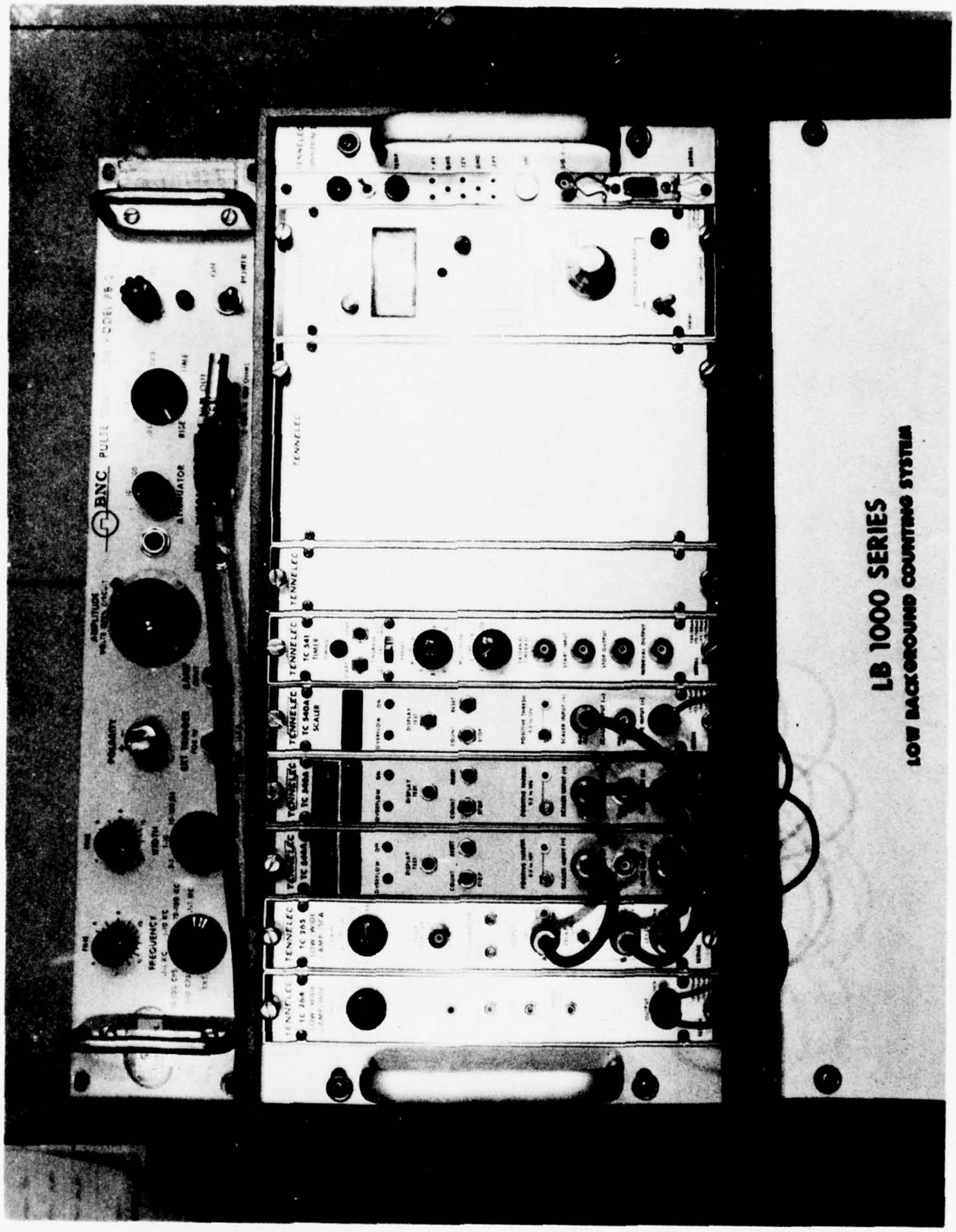

Figure 4.2. Low Background Counter

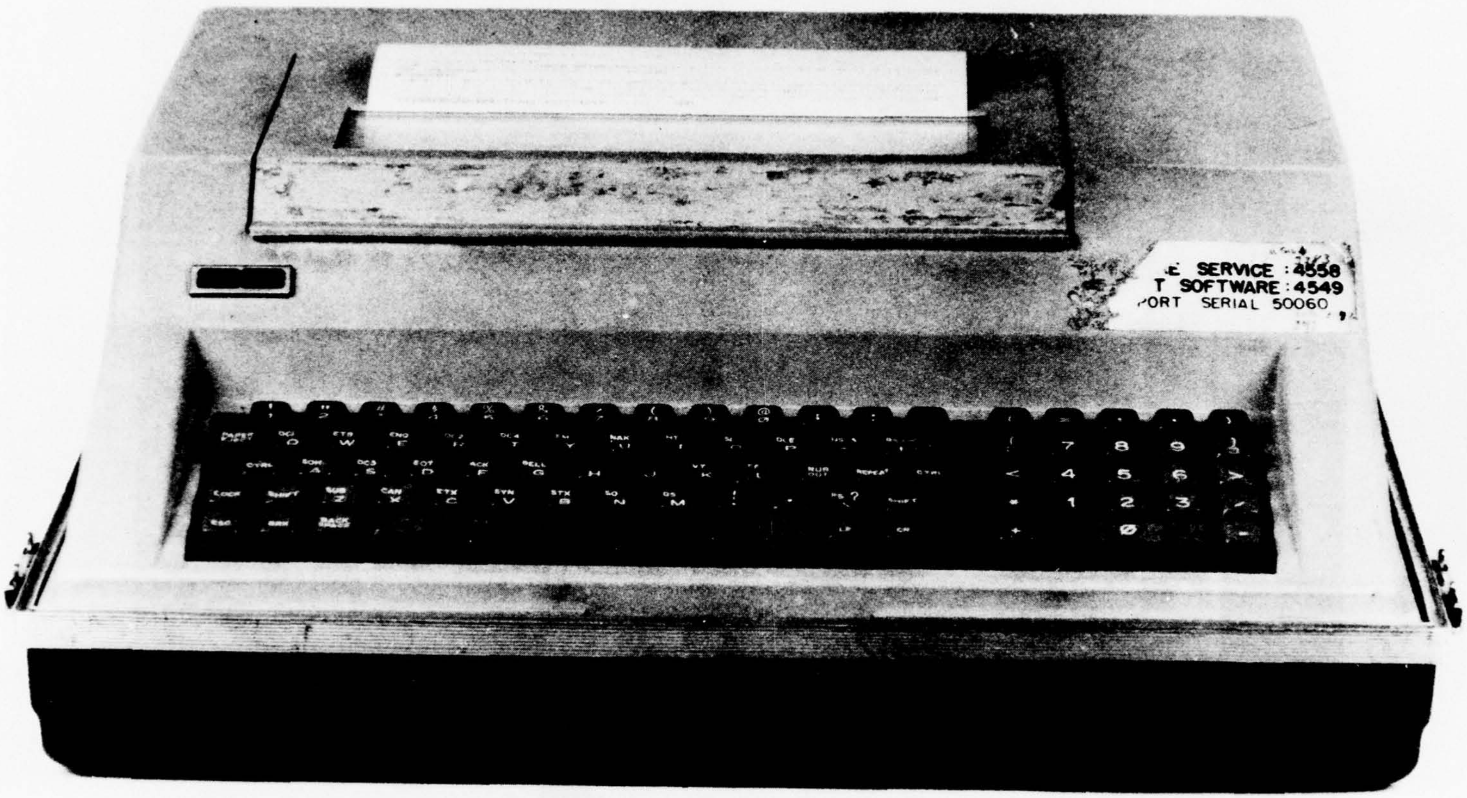

Figure 4.3. Computer Data-Link Terminal

Figure 4.4 Portable Alpha Counter

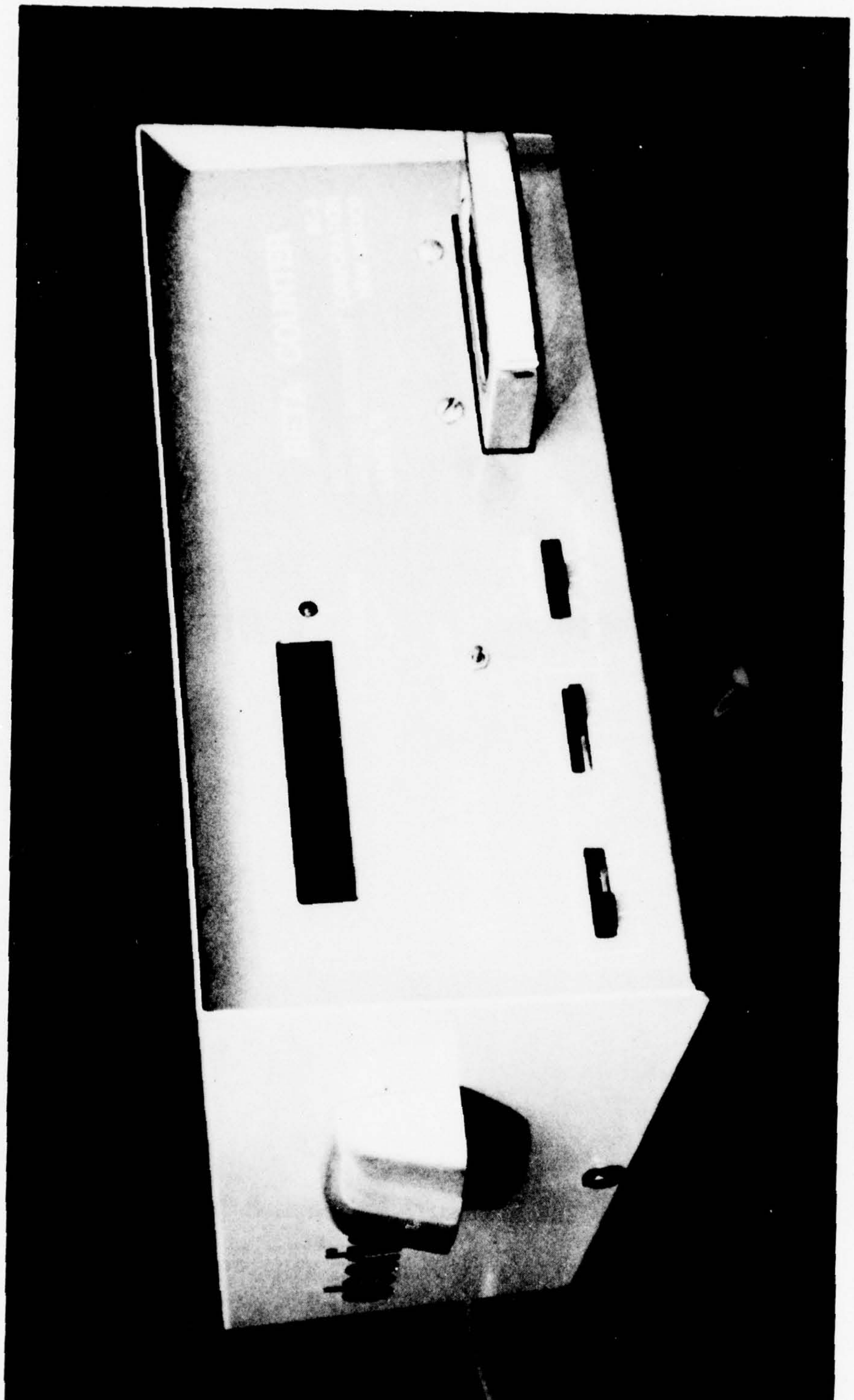

Figure 4.5 Portable Beta Counter

- Plastic bags, tubing, and polyethelyne sheets for collecting and storing contaminated trash.
- A full complement of electronic repair parts for radiac instruments.
- Liquid scintillation counter supplies.
- Multichannel analyzer support equipment.
- Miscellaneous and sundry supplies to support field operations.

4.3 Instrumentation

4.3.1 Liquid Scintillation Spectrometer

Since accident situations could produce tritium release, instrumentation for determination of tritium levels may be required. This capability for assay of tritium levels either on smears taken on surfaces, or from liquid samples taken in the vicinity of an accident, is provided by a Searle Analytic Model Delta 300 Liquid Scintillation Spectrometer. The Delta 300 is a table-top liquid scintillation dual-channel spectrometer with a 300 sample capacity bidirectional conveyor-type changer. Sample vials are lowered by an elevator mechanism into the counting chamber. Two photomultiplier tubes view the sample in the counting chamber to allow coincidence counting of a sample. Plug-in application modules allow setup for single and dual label counting. Also, a digitally-selected manual window setting module is available that provides complete flexibility. Preset count termination can be either by statistical precision or by a preset time. A crystal controlled timer employs live timing for maximum precision. The system reads out on a built-in paper-tape printer with choice of gross data, or counts per minute for each channel. Counting efficiency is greater that 60% for tritium measured on an unquenched standard in an integral counting window.

In addition, the liquid scintillation counter may be used to measure other weak betas such as those emitted by ^{14}C (efficiency, unquenched 95%). Also, betas with energies greater than 1 MeV can be measured in an unquenched sample with 100% efficiency. Similarly, unquenched samples of alpha emitters can be measured with 100% efficiency.

4.3.2 Gamma Spectrometer/Analyzer

The Canberra 8100 System 1024 channel analyzer is the core of a sophisticated automatic data retrieval/reduction system. The analyzer is interfaced with a Digital Equipment Corporation PDP-11/05 minicomputer and multiple magnetic cassette drives used for data and program software storage.

The multi-channel analyzer may be used as a stand-alone unit for gamma ray spectrum identification when less rigorous data reduction is not needed. Visual readout is available from its built-in CRT screen with digital channel/counts displayed on the screen.

The fully automated system is structured such that the multichannel analyzer is driven from a Teletype keyboard. The system may be user-programmed to conduct a complete analysis cycle and print a final report without operator intervention. A typical system produced analysis report is shown in Table 4.1. Facets of this type of automated analysis include, (a) isotopic spectrum generation representative of the unknown radiation source, (b) a quantitative and qualitative analysis of the unknown spectrum through algorithmetic comparisons against an extensive isotope library, and (c) automatic energy/source strength calibration based upon National Bureau of Standards supplied sources.

When it is necessary to measure large numbers of samples in a short period of time data reduction may be deferred by saving each sample spectrum on magnetic tape. Similarly background spectra may be stored. All data storage may be directed either under interactive operator control or through prearranged programming.

Generally, any radiation detector capable of generating electronic pulses, proportional, and thus relateable to the energy of the incident radiation, may be used with this system. This includes, but is not limited to, the FIDLER 5-inch crystal probe, various sodium iodide crystals, and high resolution germanium and silicon detectors, all of which have been used with the system. Current plans include the acquisition of a high energy resolution germanium detector that will complement the 3-inch by 3-inch sodium iodide crystal currently in use.

4.3.3 Low Background Counting System

The LB 1000 low background counting system was designed and fabricated by the Tennelec Corporation for low-level detection of alpha and beta radiation. This system has two basic parts, the detector/shielding assembly with its associated gas handling system and the electronics assembly. The detector/shielding section is composed of the sliding sample holder, a sample gas flow proportional counter and a guard gas flow proportional counter. The electronic assembly is composed of preamplifiers, amplifiers, analyzers, and scaler/timer units. The counting method used in the low background system is a gas proportional chamber using P-10 gas. The prerequisites for a low-level alpha and beta detection system include the elimination of the effects of background radiation and the enhancement of the detection efficiency for beta and alpha. Elimination of background radiation is accomplished by two complimentary methods in the LB 1000 system. First the sample and detection chamber are surrounded by an interwoven lead brick "cave", 6.35 cm thick on all sides. This shielding eliminates virtually all of the naturally occurring background gamma sources and soft cosmic rays. Hard cosmic rays are eliminated by the guard ring detector and electronic coincidence units. Detector efficiency is enhanced by using 80 $\mu g/cm^2$ Mylar window, which provides maximum transmission of the radiation of interest from the sample tray. Discrimination between alpha and beta radiation is performed electronically based upon the difference in pulse

Table 4.1. Sample Gamma Spectrographic Analysis

Radionuclide Analysis

Sample Identification: Find Coordinate SW6S

Sample Geometry: 5 cm/ge

Date Sampled: 30 June 79 Hour Sampled: 1200

Date Analyzed: 30 June 79 Hour Analyzed: 1305

Collection Time: 1200 seconds

Isotope Activity

CD-109	.4999E-1	μc/mg	(+-4.8%)
CO-57	.8581E-1	μc/mg	(+-2.8%)
CS-137	.2254E 0	μc/mg	(+-2.4%)
Y-88	.9244E 0	μc/mg	(+-1.2%)

Isotope	Theoretical Energy	Measured Energy	Difference
CD-109	87.70	87.87	.17
CO-57	122.06	121.97	-.09
CS-137	661.64	661.67	.03
Y-88	898.00	898.05	.05

Standard Deviation = .073

height. System background counts of $\leq$1.3 cpm for beta and $\leq$1 cph for alpha are obtainable. Detector efficiencies of 30% for ^{14}C and ^{210}Po with the thin window can be expected, while efficiencies of 40% for ^{90}Sr are obtainable.

4.3.4 Computer Data-Links

A computer data link is available between any field installation where commercial telephone lines are available and any one of several large computers where a number of sophisticated analytic models maintained by Team personnel are resident. The portable bidirectional data terminal is used to access computer codes which are capable of generating prediction of fallout patterns, delivered radiation dose, and effluent release patterns.

4.3.5 Portable Alpha Counter

The portable alpha counter is a scintillation type, Eberline Instrument Corporation, Model SAC-4. The complete system consists of a 5.08 cm detector, high voltage power supply, charge sensitive input amplifier, timer and six decade readout. All circuits are solid state, except the detector, with extensive use of integrated circuits to enhance reliability. The counter will accept sample sizes up to 5.16 cm diameter x 9.5 mm thick with compensation for sample thickness being accomplished by an adjustable sample holder in the slide. The scintillation phosphor is ZnS(Ag) powder placed on a plastic light pipe and is viewed by 5.1 cm diameter, 10 stage, end window photomultiplier tube. Detection efficiency is 80% of 2π minimum from a 2.54 cm diameter ^{239}Pu source. Background is less than 0.3 counts per minute.

4.3.6 Portable Beta Counter

The portable alpha counter is a Geiger type, Eberline Instrument Corporation, Model BC-4. The complete system consists of a 5.08 cm detector, high voltage power supply, pulse amplifier, timer and six decade readout. All circuits are solid state with extensive use of integrated circuits to enhance reliability. The counter will accept sample sizes up to 5.16 cm diameter x 9.5 mm thick with compensation for sample thickness being accomplished by an adjustable sample holder in the slide. The Geiger tube is 5.08 cm in diameter pancake tube with 1.4 to 2.0 mg/cm^2 window. Total window density is approximately 7 mg/cm^2 by addition of a 0.0508 mm thick mylar window, which is removable for decontamination or for counting lower energy beta such as ^{14}C. The Geiger tube is shielded from the top and sides by a minimum of 2.22 cm of lead which provides a background, typically, less than 1200 cpm per mR/hr of ^{60}Co radiation. Counter efficiencies for 2π geometry are: ^{90}Sr-^{90}Y, 77% with mylar window, 83% without mylar window; ^{99}Tc, 20% with mylar window, 48% without mylar window; and ^{14}C 15% without mylar window.

4.4 Additional Capabilities

The capability of the RADCON Team to operate successfully in the diverse radiological emergencies/scenarios in which it may become involved can be measured in terms of the abilities of the individual members of the team. Many were associated with the nuclear weapon tests in the Pacific, or at the Nevada Test Site (NTS) and have actually experienced (and measured) the radiation fields created by the detonation of a nuclear weapon. Nor have their skills atrophied over the years since these tests as can be seen from the resumes of the individual team members that are contained in Appendix C. Periodic training has maintained skills and permitted amalgamation of improved techniques with older procedures. Newer members of the team, without the experience at weapon tests, contribute to their training in the laboratory measurement of radiation using state-of-the-art technology. This combination of practical experience and academic training allows the team to bring the appropriate resources to bear on a radiological problem. However, the members of the RADCON Team are also specialists in other disciplines that are often-time applicable to the Team's mission. Contained within the Team are current experts in radioactive fallout, radiation transport phenomena, and structural effects from thermal and blast loadings, as well as specialists in numerical modeling and statistical techniques. Although all these areas are rooted in experiment, current research into these areas is primarily computational, and requires large scale computer codes. Several of these computer codes will be discussed below.

CPS, a computer code, is used to calculate concentrations and deposition of radioactive particulates and gases, which are released to the environment from a point-source. Use of this computer code would be appropriate, for example, in a reactor accident during which radioactive material is released to the environment.

In a situation involving the detonation of a nuclear weapon and the resultant dispersal of radioactive material, the computer codes DELFIC or PROFET would be used to calculate concentrations of fallout radiation. PROFET, a data-base code, would provide the desired information on fallout patterns quickly, while DELFIC, a research-type computer code, can be tailored to the specific incident.

A number of computer codes are available to perform radiation transport calculations to ascertain dose rates at selected locations due to either concentrated or dispersed radioactive material. ANISN and DOT are discrete ordinates computer codes which would be employed in situations where geometric detail can be appropriately neglected. In cases involving complex geometries, a Monte Carlo Code, MORSE, would probably be used to calculate the necessary data.

In support of these and other laboratory programs, a strong capability in computer modeling and statistical techniques has been developed. Of immediate application to the RADCON mission are the in-house data storage, manipulation, smoothing, and fitting programs. For example,

GENFIT, a program for the interactive fitting of multiple-independent-variable data by user-defined, non-linear functions was developed at the laboratory. All data processing techniques used by the laboratory are equipped with graphics packages for each plotting on either graphics terminals or CALCOMP plotters.

The blend of expertise of the members on the RADCON Team provides an in-depth capability which can be brought to bear on any radiological problem. Continual training and periodic updating of techniques ensure that the potential of the Team is maintained.

5. RADCON TEAM SIGNIFICANT EVENTS

During the over 20 year history of the RADCON Teams, they have been called upon a number of times to perform a variety of missions involving nuclear accidents or incidents. The following sections are intended to acquaint the reader with the various situations which faced the RADCON Team and how we responded to them.

5.1 SL-1 Reactor Accident

The SL-1 Reactor was a small experimental reactor under study for the military packaged reactor program. During early January 1961, there was a nuclear excursion which caused a steam explosion and the subsequent death of three operators. Extensive radioactive contamination of the interior of the reactor building resulted. In June 1963, the General Electric Co. began a clean-up effort prior to disassembly of the reactor core. The RADCON Team was asked to participate in this effort. Consequently, six members were sent to the site and they took part in advising as well as performing some of the decontamination efforts. Attending RADCON members gained experience in the many problems associated with working in an area of high beta-gamma radioactivity. These included the proper dress-out procedures, importance of careful timing, and the careful planning needed prior to entrance into the contaminated area.

5.2 Jersey City Incident

In January 1963, the RADCON Team assistance was requested by the AEC at a trucking terminal located in Jersey City, NJ. A solution containing Plutonium had leaked on the loading dock and in one of the truck trailers at the terminal. The spill was detected when the empty container reached its destination. Therefore the contamination had spread because of the length of time before detection. The RADCON Team established the extent of the contamination in the building and immediate environs.

A control point was set-up in the company office after decontamination of that area (40 x 85 foot). Monitoring revealed contamination throughout the approximately 45 x 150 foot building and in several truck

trailers. Most of the loading dock was filled with freight waiting shipment. The method of decontamination selected was a detergent scrub followed by steam cleaning because of the thick layer of grease and dirt on the concrete floor. With extensive use of Army personnel directed by the RADCON Team the entire facility was decontaminated. Final effort to remove hot spots required acid etching of the concrete floor. Truck trailers were sanded and vacuumed. The whole effort required approximately two weeks with the first week around the clock work. The RADCON Team supplied monitoring equipment, protective clothing, respirators, and obtained any additional equipment required. The RADCON Team performed all monitoring and directed clean-up operation.

5.3 Albany, New York Incident

In February 1970 a request for assistance in defining, controlling and assessing a contamination problem was made by New York State Health Department (NTSHD) to the New York Operation Office AEC through the interagency committee on Radiological assistance to the First Army. A modified RADCON Team responded.

Radioactive contamination (alpha) had been found in a laboratory building occupied by the Radiological Science Group (RSG), New York State Health Department. Investigation into it's origin led to an employee of the RSG who, in his role as a consultant and inventor, had apparently taken radioactive sources home and had worked with them in his garage and home workshop.

His actions had caused extensive contamination to become widely spread. At the invitation of the RSG employee, the RADCON Team conducted a radiological survey of his home. The first floor had no detectable beta-gamma radiation, but alpha surveys with the AN/PDR-60 verified previous NYSHD findings. However, much larger areas of contamination were detected with the FIDLER probe, especially in the wall-to-wall carpets, upholstered furniture, and plumbing traps. The basement area could not be given a contamination level as the instrument read off-scale, over 500,000 cpm. It was concluded that all items in the house should be treated as contaminated and controlled accordingly. The next area surveyed was a former laboratory building from which the Radiological Science Group had moved two years earlier. Contamination was found on the floor. Using the FIDLER probe, readings ranged from 10,000-500,000 cpm in the area that the employee had occupied. Smear sample indicated no removable activity. It was learned that this building had been remodeled since the RSG moved out including the replacement of floor tile. The RADCON Team also surveyed the school building which the employee's son attended and found two books, a ruler, and a pencil bag in the boy's desk slightly contaminated. Next, the employee's office and work area were surveyed. Contaminated spots were found on office furniture, books, files, etc.; also several pieces of electronic equipment had smearable activity on them.

The results of the RADCON Team's surveys and findings were verbally reported to the Commissioner of Health. Based upon the reports of both the RADCON Team and his department, the Commissioner directed his legal staff to take immediate action to order the vacancy, sealing, and quarantine of the employee's home. It was reported that both father and son had a full body burden of Americium (^{241}Am). Because of this report, the RADCON Team recommended that public health authorities do a follow-up survey on two foreign domestic employees that had lived in the house. These individuals had returned to Germany. It was also recommended that the contractor, his personnel and equipment utilized in the remodeling of the former laboratory building be checked out by public health personnel. It was recommended that all contaminated items be placed in 55 gallon drums and sealed for disposal. The RADCON Team further recommended that more air sampling measurements be taken in the ventilating system of the two laboratory buildings in which employee had worked, and finally a report of all findings be forwarded to the AEC.

5.4 Operation Sand Patch

On 11 July 1970 an Athena Missile containing 935 mCi of Cobalt 57 fired from the White Sands Missile Range (WSMR), NM impacted in the State of Chihuahua, Mexico. On 2 Aug 1970, the precise impact point was located by a specially equipped aircraft. On 7 August 1970 a four man RADCON Team proceeded to the impact area to perform a radiological survey. This survey determined a level of 0.6 mr/hr in the center of the crater and levels greater than approximately 0.1 mr/hr in the adjacent area. The Mexican government required that all material contaminated to a level greater than 0.1 mr/hr be removed and that material contaminated to less than 0.1 mr/hr be treated until the level of 0.03 mr/hr (normal background) was reached.

The excavation of the contaminated material was achieved by heavy equipment supplied by WSMR, loading the soil into 55 gallon drums, and transporting the soil to the WSMR radioactive material storage area. The material contaminated to less than 0.1 mr/hr was diluted with uncontaminated soil by digging trenches on either side of the 20 x 50 meter area and pushing the contaminated material into the trenches and working it back and forth until the background level was achieved.

The RADCON Team role in this operation included the initial survey, the identification on the contaminated material to be removed, recovery action planning advice to the onscene commander, hot line operations during the excavation, monitoring of personnel and equipment used during the operation, supervision of decontamination operations, and final survey.

Although the entire operation was conducted over an almost 3 month period the actual operational activities were accomplished in approximately 2 working weeks. The delays were due to necessary working level

and Defense and State Department Consultations with the Mexican government, the preparation of a detailed operations plan, a period of severe inclement weather, and the remoteness of the impact area.

Since the excavation was conducted in a remote area the necessary heavy equipment was brought to the general location by train which was positioned at the town of Carrillo, approximately 19 miles from the impact point. The fact that the train was also the living quarters and contained the eating facilities for the operational personnel required that strict health physics procedures be adhered to. Assurance of this was accomplished by daily monitoring of the train and surrounding area. As the drums containing the contaminated soil were boarded additional surveys were employed to assure that all decontamination of exterior surfaces was accomplished prior to the drums departing the excavation site. Once the train was loaded and departure took place, a final survey of the railroad site assured that no radiological hazard existed. The operation was successfully accomplished to the satisfaction of the Mexican government with the absolute minimum of exposure of the operational personnel.

5.5 Special Storage Facilities Incident, Clarksville Base, Fort Campbell, Kentucky

The Clarksville Base area of Fort Campbell, Kentucky, under the control of the Defense Atomic Support Agency (DASA), was used for storing and handling special nuclear material from 1949 to 1969. Upon release by DASA to Fort Campbell in 1969, the Commanding General, Fort Campbell, requested that US Army Environmental Hygiene Agency (AEHA), Aberdeen Proving Ground, MD perform the following study: (1) survey the facilities at Clarksville Base for possible contamination resulting from the storage and handling of special nuclear materiel, (2) evaluate the potential health hazards resulting from naturally occurring radioactive material, and (3) evaluate two radioactive waste disposal areas. The AEHA requested that the Army RADCON Teams assist in the study.

The Base consisted of a number of above and below ground buildings and igloos that had been used as special weapons magazines or shops. All of these buildings were (1) monitored with alpha, beta, and gamma-ray survey instruments, (2) had dry and wet wipe samples taken from floors and other surfaces, and (3) had one liter room air samples taken for analysis of radon concentrations. The two waste disposal areas were located in the approximate center of the Clarksville Base and were monitored with survey instruments. In addition, soil samples and water samples were taken from nearby streams.

The results of the study produced the following conclusions:

1) No contamination from special nuclear material or tritium was present at Clarksville Base.

2) The levels of radiation being emitted from material buried in each of the radioactive waste disposal areas was negligible.

3) The possibility of loss of ventilation in Building 318 and the subsequent buildup of contamination (>70xMPC) of airborne radon could present a severe health hazard. It was recommended that material deemed salvageable be removed and the building permanently secured against any further entry.

4) Radon concentrations in the other underground facilities are such that their use should be limited to static storage with occupancy only to place and remove material stored in them.

5.6 Classified Incident

In October 1972, the RADCON Team was requested to provide assistance to the Army Environmental Health Agnecy (AEHA) in assessing the radiation hazard associated with an incident which had occurred a number of years previously. This incident had resulted in the extensive contamination of a few acres of land on a military post. A modified (six man) team was dispatched to the site and extensive surveys were conducted. However, since at least two attempts had previously been made to "fix" the contamination, the task of establishing quantitative radiation levels was complicated. Further, extensive migration of the contaminant had occurred, thus necessitating the survey of a much larger area than had previously been anticipated. Air samples were taken, but no airborne activity was found. However, soil migration necessitated the taking of soil and water samples which were subsequently returned to the laboratory for analysis. Fortunately, previous experience of several of the RADCON Team members resulted in the employment of previously validated soil sampling techniques. There is no doubt that this previous experience was invaluable in this particular incident. Further, the translation of the actual radioactivity levels found in the soil samples to quantification of the overall hazard is a very complex task. The extensive and diversified talents of the RADCON Team members made such a translation, not only possible, but believable as well.

Although the security classification of this incident negates a detailed description of much pertinent information, it should be noted that the results obtained proved invaluable to major decisions regarding land usage and ultimate disposal.

5.7 Red River Army Depot Incident

On 24 July 1973, fire destroyed a wood frame single story structure, at Red River Army Depot. This building was used as a facility to refurbish M-66 Rocket Launchers. Approximately 3,000 launchers were involved in the fire. Each launcher contained either no radioactive components or as much as 3 millicuries of promethium (^{147}Pm). This material was used to illuminate the launcher gun sight. Each sight was imbedded with 40-75 micron size microspheres of (^{147}Pm). The individual microspheres were designed to avoid loss of integrity due to mechanical or heat stress. While the fire did destroy some of the plastic gun sight and released the microspheres, these microspheres did remain intact which resulted in no airborne or smearable radioactivity.

Operations by the RADCON Team commenced with a background air sample and downwind air samples being taken at the fire site. No unusual radioactivity was found. The access roads, driveway and downwind areas were surveyed, and no radioactivity was found. Next the RADCON Team entered the site in support of the arson investigation team. Our preliminary conclusion was that residual contamination is limited to the building and loading dock area. The RADCON Team, in conjunction with the Red River Depot Radiation Protection Officer (RRAD RPO), developed a plan of operation for the recovery of the fire site. However, this plan was not immediately implemented because an earlier investigator reported to higher command that he had obtained a smearable sample that had 3500 cpm of radioactivity. Many hours of the RADCON Team's time was wasted obtaining unnecessary smear samples to prove this report erroneous.

The RADCON Team recommended the release of a dump truck, fork lift, air compressor, and two loaded vans after they were surveyed. Also, that all uncontaminated combustible items be disposed of by burning or in a land fill, and uncontaminated metallic objects released to salvage. All contaminated items were to be packaged and disposed of in accordance with AR 755-15 by the RRAD RPO. After all of the rubbish had been removed from the site a coat of road tar was to be placed over the concrete slab which was formerly the building floor.

5.8 Weldon Spring Chemical Plant Survey

The radiological survey of the Weldon Spring Chemical Plant (WSCP) was performed by the US Army RADCON Team at the request of the Project Manager for Chemical Demilitarization and Installation Restoration (PM-CDIR), Aberdeen Proving Ground, Maryland. Weldon Spring Chemical Plant is located 2 miles west of Weldon Spring, Missouri, on an Army site of approximately 220 acres. Originally this tract of land was a portion of some 17,000 acres owned by the US Army and utilized for the manufacture of explosives.

In the mid 1950's the Atomic Energy Commission (AEC) began to centralize its uranium production facilities and acquired the WSCP site from the Army in order to construct a plant to produce and extrude uranium metal. Construction began in December 1954, and the plant was completed in September 1958. The Mallinckrodt Chemical Company of St. Louis, Missouri, serving as as AEC prime contractor, operated the WSCP until 1966 when the AEC operation was shut down.

The entire plant lay dormant until 1968 when the US Army reacquired all but 58 acres of the site in order to produce the chemical defoliant Herbicide Orange for use in Southeast Asia. However, before renovation was completed, use of the defoliant was discontinued and the Weldon Spring site became excess property. Assessment of this property is under the jurisdiction of the PM-CDIR and currently is part of the Army's Installation Restoration (IR) Program. A principal step in the IR Program is the overall assessment of potential hazards that could be

experienced should the site be restored for civilian occupation. Since the WSCP function involved the production of uranium, it was necessary to include an investigation of the possible nuclear radiation contamination hazards on the site. In order to accomplish this, the PM-CDIR requested DARCOM to task the RADCON Team with a preliminary radiological survey of the WSCP. This request was approved and the radiological survey was conducted during the period 8-12 September 1975.

Since natural uranium and its decay products were anticipated to be the source of contamination, the primary instrument employed for the survey was the Eberline Instrument Company Model E520 beta-gamma meter with a Model HP 210 probe (2.0 mg/cm^2 window thickness). As a supplement to the E520, the FIDLER was used to detect low energy x-ray photons emitted by the uranium and thorium decay chains.

The primary objectives of the survey were to: (1) determine outdoor areas of radioactive contamination (2) identify the contaminants and (3) assess the potential radiological hazard to the properties surrounding the site. Building interiors were not included in the site survey.

At the time of the survey the WSCP site constituted a very real radiological hazard within the US Army property boundaries. Those locations that contained radioactive contamination were limited to the basic process and support building areas and those areas which contained equipment, trash and general waste materials. Contaminant was migrating off site at three different locations and conditions existed at two other locations where this problem could also develop. Natural uranium and thorium and their decay products comprised the list of radioactive contaminants found at the WSCP site. These isotopes do not constitute an external radiation exposure hazard but rather a potential toxic (heavy metal poisoning) and radiobiological hazard if they enter the food chain or are ingested by some means.

The PM-CDIR was advised that release of the site for the purpose of unrestricted use could not be effected without complete decontamination. In addition, it was recommended that a detailed and comprehensive radiological survey be conducted in order to formulate an effective decontamination program. This recommendation was followed and currently members of the RADCON Team are serving as consultants to the PM for the purpose of reviewing contractor proposals and monitoring on-site progress.

5.9 Frankfort Arsenal Survey

In 1977 at the request of the U.S. Army Demilitarization Team the BRL RADCON Team performed three radiological surveys of the Frankfort Arsenal to facilitate the release of two areas to the State for other uses. Area A, a ten acre section containing 23 buildings, was primarily an administration and housing area. The area was surveyed for fixed and removable alpha, beta and gamma, and found free of any contamination. Area B had a number of laboratory sections in which tritium may have

been used. Therefore, area B was also surveyed for tritium. Two buildings in this area were found to have suspect contamination and were not recommended for clearance.

The processing section of the arsenal (most of which had known U-238 contamination) along with the two buildings found to be contaminated were surveyed and decontaminated by commercial firms on contract. The RADCON Team supplied technical monitoring of the contract effort.

5.10 NUWAX-79

In April 1979 the RADCON Teams participated in a joint DoD and DoE planned nuclear weapon accident exercise called NUWAX-79. NUWAX-79 was the first planned exercise designed to evaluate various radiological emergency response teams and their abilities to respond, operate, and perform in a field situation. Because of the significance of this operation a detailed discussion is contained in Appendix D.

6. SUMMARY

This report has attempted to acquaint the reader with what the US Army RADCON Teams are, how they operate, how they are presently constructed and their overall capabilities. It is hoped that the reader now has an appreciation of the effort, both past and present, which has been and is necessary to develop and maintain the required operational status of such emergency teams. The response of the teams to the variety of incidents and accidents which have occurred during the past twenty years has certainly demonstrated the necessity for the existence of such teams. The fact that the teams have been active and successful has, in no small part, been due to the dedication and interest of the team members.

In the near future a number of the present members will approach retirement age, and thus, an intensive training program will have to be undertaken to ensure that the ability of the teams to respond will not be compromised. To accomplish this, increased resourced, in terms of both funding and dedicated manpower will be required. Further, it is expected that due to recent national interest in the overall subject of radiological emergencies, the RADCON Teams will eventually receive additional attention and thus it is imperative that the highest state of readiness be maintained.

In summary, the US Army RADCON Teams, as presently constituted, have been trained and equipped to accomplish all aspects of their assigned mission. Further the unique capabilities of the members of the teams enable them to deal with almost any nuclear emergency.

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APPENDIX A

STANDING OPERATING PROCEDURE FOR US ARMY RADCON TEAM

1. General

a. Purpose

This SOP is established to set forth the normal procedures for operations involving the employment of the US Army RADCON TEAM (RT). This team is composed of staff members of the Vulnerability/Lethality Division and other elements of the US Army Ballistic Research Laboratory (BRL), Aberdeen Proving Ground, Maryland 21005.

b. Scope

Unless orders from competent authority are received in conflict with portions of this SOP, the procedures outlined below will be followed.

2. References and Authority

AR 50-5 Nuclear Weapons and Materiel:
Nuclear Surety

a. Defines the meaning of "nuclear accident and incident", JNACC, NAIC, and NAICO.

b. States that the DARCOM is responsible to provide RADCON teams (5.2.F.5) to perform radiological surveys and assist as advisor in control and decontamination measures at the scene of a nuclear weapon accident or incident and provides that the information in FM 3-15 will be used in the training and employment of the teams.

c. Provides the NAIC nicknames (flagwords) and definitions for reporting nuclear weapon accidents and incidents (BROKEN ARROW, etc.).

DARCOM Supplement 1 to AR 50-5, Nuclear Weapons and Materiel
Nuclear Surety provides the following:

a. The Director, BRL will organize, equip and train a minimum of two RADCON Teams as prescribed in FM 3-15.

b. A proper response plan will be prepared and maintained, which gives either team the capability to depart for the scene of a nuclear weapon accident within four hours after notification.

c. RADCON Team assistance may be requested from the Director, BRL, or the Chief, Radiation Engineering Branch, Vulnerability/Lethality Division. However, the Special Assistant for Nuclear

Affairs, Headquarters DARCOM must be notified of any requests for assistance.

d. RADCON Teams may be requested by the NAICO as on-scene commander.

e. JNACC and the DARCOM Nuclear Surety Group will be kept informed of the locations, status, composition and capability of the RADCON Teams.

f. A RADCON Team, when on site, will remain there until released by the on-scene commander.

g. An appendix on the BROKEN ARROW Response Kit includes a description of the three radiation detectors in the kit and the manner of standardizing and using them.

h. The DARCOM Nuclear Surety Office will be kept informed of changes or revisions to the RADCON Team response plan.

FM 3-15 Nuclear Accident Contamination Control

Provides guidance for training, equipping and utilizing RADCON and other emergency teams for nuclear accident or incident radiological contamination control.

AR-385-40 Safety-Accident Reporting and Records

Provides for nickname and definitions for reporting reactor accidents and incidents.

DARCOM Disaster Control Plan

Provides that DARCOM will furnish RADCON teams on request and authorizes RADCON Team Emergency assistance for radiological accidents other than those involving nuclear weapons or nuclear reactors.

ERDA-10 Interagency Radiological Assistance Plan

Provides for the RADCON Team to contribute to a coordinated Federal agency response for radiological assistance in the event of a peacetime radiological incident.

AMCR-10-94 (Change 1 staffed at HQ DARCOM)

States that BRL will respond to Nuclear Reactors/Radioactive Materiel and other Radiological Emergencies.

3. Organization

a. General

(1) The Director, US Army Ballistic Research Laboratory will appoint members of each of two RADCON Teams.

(2) All team members will have at lease a SECRET Security Clearance, and be authorized access to Restricted Data and Critical Nuclear Weapon Design Information.

b. Personnel

(1) Each RT will be composed of a Team Leader and at least eight other individuals as outlined in Chapter 6, FM 3-15.

(2) Each person will be well qualified for surface monitoring for alpha, beta, and gamma contamination and will have a working knowledge of personnel decontamination.

4. Equipment

Each team will be equipped with a minimum of the items listed in FM 3-15 Chapter 6. This equipment will be maintained in a ready status. The gross weight of the Team equipment plus personal equipment for initial movement by air should not exceed 3600 pounds.

5. Responsibilities

The US Army RT will:

a. Arrive at the accident site as soon as possible following notification by the US Army Materiel Development and Readiness Command (DRCSA-NS), or Joint Nuclear Accident Coordinating Center (JNACC).

b. Assess the alpha and beta-gamma hazard at an accident or incident involving a nuclear weapon, nuclear power plant, or any other event involving nuclear wastes, reactor fuel elements, or radioactive sources. Define the hazard area.

c. Perform alpha and beta-gamma monitoring as required, particularly during decontamination or other control operations, and provide technical supervision of such tasks.

d. Certify jointly with the medical representatives that the area is free of radiation hazard following the operation.

6. Sequence of Events

a. The RT will proceed to the accident site as follows: Normally,

an advance party, consisting of the RT Leader and a minimum of one monitor will depart within four hours after receipt of an alert and will proceed to the accident site. The remainder of the Team will be assembled and will proceed to the accident site upon notification by advance party.

The advance party will carry at least one flyaway case containing alpha and beta-gamma radiacs, one Broken Arrow Response Kit and protective gear for one day's operation (FM 3-15 Figure 6-1 (1) and 6-1 (2)).

b. Upon receipt of an alert, action is taken by RT members as follows:

(1) The Team Leader

(a) Coordinate with DARCOM Headquarters, DRCSA-NS, AUTOVON 8-284-9554 or 8-284-9610.

(b) Contacts alternate RT Leader to initiate notification of Team personnel to assemble immediately in the conference room at Building E5695.

(c) Notifies the Chief, Vulnerability/Lethality Division telephone 278-3682, of alert action, who in turn informs the BRL Director.

(d) Contacts Chief, Administrative Support Division (ASD) BRL, telephone 278-4892, for execution of pre-cut travel orders.

(e) Contacts APG Emergency Operations Center, telephone 278-5225, who will:

(1) Contact Comptroller personnel for travel and cashier action.

(2) Contact Movement Services personnel for transportation (See para 7a).

(2) The Alternate Team Leader

(a) Assembles Team personnel at Building E5695 and assures that they are prepared and equipped for an extended stay at accident site. Dispatches Class A agent to ASD to hand carry orders and pick up funds.

(b) Upon notification from advance party that additional team support is required coordinates movement of required additional team members and supervises checking and loading of required team equipment.

(c) Prior to departure, notifies JNACC Kirtland Air Force Base, Albuquerque that the RT is responding to a call (telephone AUTOVON 8-964-8279, commercial 1-505-264-8279). Likewise notifies DARCOM Headquarters, DRCSA-NS, (telephone AUTOVON 8-284-9554/9610, commercial

1-202-274-9554/9610 during duty hours; during non-duty hours, DARCOM Staff Duty Officer AUTOVON 8-284-9223, commercial 1-202-274-9223).

(3) The Equipment Specialist will ensure that batteries and other equipment not prepackaged are checked and loaded.

(4) The Health Physicist will ensure that film badges and dosimeters are checked and loaded.

(5) Team Members, upon notification of an alert, will assemble at Building E5695 with necessary personal items for an extended stay at the accident site. Weight of personal items should not exceed 65 pounds per Team member.

c. Upon arrival at the accident site, the RT Leader will:

(1) Report to NAICO and determine status of events at the accident site, by coordination with various other teams (EOD, CBR, ALPHA, RAMT, etc) that may have already responded.

(2) Report his Team's arrival time and date to Chief, VLD and DARCOM, DRCSA-NS. If the Team has traveled in increments, report the arrival of the separate increments.

(3) Assist the NAICO as requested.

(4) If a civilian carrier or civilian property is involved in the incident, obtain through the NAICO a "request for assistance" in writing.

(5) Caution all Team members to refrain from comments as to the extent and degree of damage and contamination and to refer all inquiries to NAICO.

(6) Perform monitoring and sampling functions as indicated in FM 3-15 Chapters 8, 9, and 10 determining the extent of alpha, beta, and gamma contamination; however, the immediate vicinity of weapons or components of weapons will not be monitored until the EOD Team has completed its "render-safe" operations.

(7) Supervise decontamination procedures as indicated in FM 3-15, Chapter 11.

(8) Maintain records and render reports as indicated in Annex 1.

(9) Observe safety precautions indicated in Annex 2 and ensure protection of Team members against hazards indicated in FM 3-15, Chapter 3.

(10) Upon completion of decontamination, in company with senior medical representatives, furnish certificate to NAICO that area is free of radiological hazards.

(11) Recommend to NAICO that the Army Teams and the RT be relieved when they are no longer needed.

(12) Obtain a written certificate of release by the NAICO.

(13) When relieved by NAICO notify Chief, VLD and DARCOM, DRCSA-NS and return with RT to APG, MD.

d. Upon return of RT to APG, RT Leader will:

(1) Report date and time of arrival to Chief, VLD and DRCSA-NS.

(2) Have equipment properly stored in Building E5695, and release personnel from alert status.

(3) Report status to JNACC.

(4) Ensure that records and reports are completed in accordance with Annex 2.

7. Administrative Details

a. Transportation. The RT will be provided transportation by the Transportation Officer, APG, Maryland.

(1) Within 300 miles of APG, the RT will be furnished one tractor/semi-trailer, 3 each ½ ton truck carryalls, or rental vehicles.

(2) Beyond 300 miles of APG, the RT will be furnished ground transportation to the airport and air transportation to the nearest airfield at the accident site. Commercial transportation will be utilized, if necessary, for transportation to the site.

(3) Movement of 12 ton semi-trailer may be requested to the site.

(4) Necessary transportation at the accident site will be provided by the NAICO.

b. Travel Orders

Travel orders will be prepared for each member of the RADCON Team on an annual basis by the REB, BRL. Orders will be filled out in their entirety (including authorization signatures) with the exception of itinerary (block 11), issue date (block 21) and travel order number (block 22). The information for these three blocks (11, 21 & 22) will

be supplied to/by the Administrative Support Division (ASD) Travel Section, BRL upon notification of RADCON Team alert. The information will be annotated on the travel orders by ASD personnel prior to issuance and subsequent departure of RADCON Team personnel.

c. Funds

Prior arrangements have been made with the APG Procurement Directorate authorizing the RT assistant team leaders to act as ordering officers.

d. Records and Reports. See Annex 1.

e. Team Members.

All Team members will keep the RT Leader informed of current home and duty address and phone number. In the event a Team member should be absent from either his duty or home address for a period in excess of 4 days, he will inform the RT Leader where he can be contacted during such absence.

f. Radio.

The radio call name for the Team is "ERRANDBOY", and all radios will operate on a frequency to be determined at the accident site.

8. Training

a. All RT members will be trained in alpha, beta and gamma monitoring. Routine training of this nature will be periodic to ensure adequate functioning of the Team.

b. Training to qualify individual Team members in their particular Team duties will be conducted as directed by the RT Leader.

c. Sufficient personnel will be trained so that the Team can be constituted and dispatched in time to reach an accident site within 24 hours after request.

d. Tests and rehearsals will be conducted as necessary to ensure readiness of the Team. Results of such tests and rehearsals will be reported in writing through command channels to Commander, US Army Materiel Development and Readiness Command, ATTN: DRCSA-NS, 5001 Eisenhower Avenue, Alexandria, Virginia 22333.

LIST OF ANNEXES

ANNEX 1 TO SOP FOR US ARMY RADCON TEAM

RECORDS AND REPORTS

1. General. The RADCON Team (RT) will prepare and maintain records and reports as indicated below by making full use of Forms RC-1 through RC-16 included as Annex 5.

2. Area Maps and Overlays.

a. Team will prepare necessary sketch maps, if sufficiently detailed maps of the accident are not available locally.

b. Original of each sketch map and contamination overlay will be retained by the Team. Copies will be furnished to the Incident Control Point as directed by the NAICO.

c. Contamination maps or overlays will show, in addition to other data, the general area of contamination, contamination levels, date, starting and end times of surveys, and time of accident if known.

d. Original data sheets used in collecting survey and sample data will be retained by the Team. (See Forms RC-7 through RC-15).

3. Operational Log.

a. The operational log will contain a chronological sequence of events, and besides other pertinent information will cover the following: (See Forms RC-1 through RC-5).

(1) Time and date RT alert notice was received.

(2) Time and date RT departed the unit area.

(3) Grade and name of each Team member participating in the alert.

(4) Routes of travel involved, including geographical locations of end points, departure and arrival times and dates, and modes of transportation.

(5) Identification (by map coordinates if possible) of scene of accident, with pertinent details concerning nature of accident.

(6) Hours of operation.

(7) Services rendered.

(8) Equipment utilized.

(9) Injuries to RT personnel.

(10) Film badge identifications for RT personnel (See Form RC-6).

(11) Press releases provided to the NAICO by the Public Affairs Officer (cy of each).

(12) Other official documents accomplished by the RT (cy of each).

(13) Time and date RT returned to the unit area.

b. Original copy of the log will be retained by the RT.

4. Reports.

a. Upon completion of the RT mission and return of the Team to the unit area, the Team Leader will prepare the following reports:

(1) A duplicate copy of the operational log.

(2) A copy of each area map and overlay.

(3) Recommendations for improvements in the procedures for coping with future accidents.

b. The Team Leader will assure that film badges of Team members are processed. When results are available, submit supplemental report of exposures through channels indicated in previous subparagraph. Results of any urine samples taken, if available, will be submitted.

SAFETY PRECAUTIONS

1. Use of Dosimetry Devices.

a. Exposure Limits.

RADCON Team (RT) Leader will establish procedures to ensure that personnel of his team are exposed to the minimum beta-gamma radiation commensurate with the mission.

b. Film Badges.

(1) Each RT member will wear a film badge at the accident site. (See Form RC-6).

(2) Film badges will be processed at the completion of the team mission or more frequently if directed by the RT Leader. Individual exposure records will be completed in accordance with AR 40-14.

c. Pocket Dosimeters.

(1) Each RT member will carry 2 high-range pocket dosimeters and 2 low-range pocket dosimeters at the accident site until it is determined that beta-gamma contamination is not involved. (See Form RC-16).

(2) Pocket dosimeters will be checked periodically to assure that team members have not been overexposed. Readings of pocket dosimeters will be used as a check and a supplement to the film badge dosimetry.

d. Urine Sampling Kits.

(1) All team members will submit, annually, 24-hour urine samples for baseline determinations of uranium, plutonium, americium, gross alpha, and gross beta-gamma concentrations.

(2) When directed by medical personnel at the accident site and after return, 24-hour urine samples will be taken from each Team member exposed to alpha radiation. Samples will be taken and processed in accordance with the BRL Radiation Protection Manual. Samples will be discoutinued when appropriate.

e. Nose Swipes.

(1) Nose swipes are used to assist in determining whether or not any contaminated material has been inhaled; they do not provide quantitative information as to the total extent of exposure.

(2) Nose swipes will be taken on Team personnel as directed by the Health Physicist. This will normally be at the end of a working period in an alpha-contaminated area. Samples will be processed as soon as possible.

2. Protective Clothing and Equipment.

a. The requirement for protective clothing and equipment is dependent on the contamination levels encountered.

b. The Health Physicist or the RT Leader will advise on the proper clothing and equipment to be used. The following general criteria will be observed:

(1) Full protective clothing will be worn for initial entry into the accident area until contamination levels have been determined.

(2) Following determination of contamination levels, minimun protective clothing commensurate with these levels will be worn.

(3) For dusty conditions, full protective clothing and equipment will be worn.

3. Other Precautions.

a. Food. The preparation or storage of food in contaminated areas is prohibited.

b. Eating, Drinking, Smoking. In contaminated areas, eating, drinking, and smoking are prohibited.

4. Control of Contaminated Area.

a. The RT will assist the NAICO as required in establishing a security perimeter outside of the contaminated area. The perimeter will be marked with cloth tape and/or radiation danger signs at appropriate locations.

b. Each individual exiting the controlled area will be monitored to ensure that the skin and clothing are free of radioactive contamination. If contamination levels are exceeded, individuals will be decontaminated. The RT will supervise the establishment and operation of the monitoring and decontamination station.

c. Prior to entering the area of contamination, personnel will be briefed by a RT member as to the contamination situation.

d. Individuals or parties desiring to enter the contaminated area must clear through the RT Leader and will be accompanied by a monitor from the local Team or the RT unless monitoring service has been supplied by the individual's own organization or Team.

ANNEX 3 TO SOP FOR US ARMY RADCON TEAM

The following definitions apply for reporting purposes. For the purposes of this report, nuclear components also are included. (AR 50-5 and 385-40, and DARCOM Suppl 1 to AR 385-40):

NICKNAME	DEFINITION
NUCFLASH	Nuclear Weapon war risk accident An event which results in the accidental, unauthorized, or any other unexplained nuclear detonation.
BROKEN ARROW	Nuclear Weapon accident An unexpected event involving nuclear weapons or nuclear components that results in any of the following: (1) Nonnuclear detonation or burning of a nuclear weapon. (2) Radioactive contamination. (3) Seizure, theft, or loss of a nuclear weapon or nuclear component, including jettisoning. (4) Public Hazard, actual or implied.
BENT SPEAR	Nuclear Weapon significant incident An unexpected event involving nuclear weapons or nuclear components which does not fall in the nuclear weapon accident category but results in any of the following: (1) Evident damage to the extent that major rework, complete replacement or examination, or recertification by the Energy Res & Dev Administration (ERDA) is required. (2) The striking of a nuclear weapon by lightning or when a commander suspects that lightning has degraded the safety or reliability of a nuclear weapon system. (3) When it is known or suspected that a nuclear weapon has been partially or fully armed. (4) An incident in which there is a possibility of adverse public reaction or release of information to the news media which is deemed to be of such importance as to warrant the immediate attention of HQDA, even though a public hazard does not exist.

NICKNAME	DEFINITION
	(5) An attempted penetration, actual penetration, or other unexpected degradation of security of nuclear weapons sites, activities, and/or logistical movements of weapons.
DULL SWORD	Nuclear Weapon minor incident An unexpected event involving nuclear weapons not reportable as a nuclear weapon accident or significant incident but which results in any of the following: (1) Damage to the warhead section or warhead which Army organizations are authorized to repair, or malfunctions of associated equipment which could result in damage to the warhead section or warhead. (Associated equipment includes test, handling, launch, control, arming and monitoring systems.) (2) Damage, loss, or destruction of an ERDA nuclear-type training weapon. (3) Unauthorized acts which degrade the safety or security of a nuclear weapon or ERDA type trainer unless reportable as an accident or significant incident. (4) Any other condition which is considered reportable by a commander or custodian of a weapon.
FADED GIANT	Nuclear reactor accident An uncontrolled reactor criticality resulting in damage to the reactor core or release of fission products from the reactor core to the atmosphere or surrounding environment. Guidelines for determining whether an accident within this general description has occurred include: (1) A fatality or disabling injury to an individual as a direct result of the accident. (2) Seizure, theft, or loss of any reactor fuel. (3) Damage to property in excess of $100,000. (4) Release of radioactive material exceeding 5,000 times the limits specified for materials listed in appendix B, table II, title 10, part 20, Code of Federal Regulations, when averaged over a period of 24 hours.

NICKNAME	DEFINITION
	(5) Exposure of the whole body of any individual to 25 rems or more of radiation; exposure of the skin of the whole body to 150 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms to 375 rems or more of radiation.
(No nickname)	Significant Nuclear reactor incident An unexpected event resulting in any of the following: (1) Exceeding a safety limit as defined in the technical specifications. (2) Inadvertent, unscheduled, or uncontrolled exposure of personnel to any radiation in excess of allowable limits prescribed by AR 40-14. (3) Radioactive contamination of personnel and property or release of radioactive material in excess of 500 times the limit for materials listed in title 10, part 20, Code of Federal Regulations, when averaged over a period of 24 hours. (4) An incident in which there is a possibility of adverse public reaction or release of information to the news media, such as public hazard, actual or implied, or any unexpected event not specifically listed which prudence or good judgement dictates to be of such consequence or potential as to warrant the immediate attention of HQDA.
(No nickname)	Abnormal Nuclear reactor occurrence An occurrence of any reactor system that: (1) Results in a safety system setting that is less conservative than a limiting safety system setting as established in the technical specifications, or (2) Violates a limiting condition for operation as established in the technical specifications, or (3) Causes any uncontrolled or unplanned release of radioactive material from the site, boundary, or (4) Prevented or could have prevented the performance of the intended safety function of an engineered safety feature system or of the reactor protection system.

NICKNAME	DEFINITION
	(5) Results in an abnormal degradation of one of the several boundaries which are designed to contain the radioactive materials resulting from the fission process, or results in the uncontrolled or unanticipated changes in reactivity, except for reactor SCRAM, greater than 1 percent delta k over k.
	(6) Results in observed inadequacies in the implementation of adminstrative or procedural controls such that the inadequacy causes or threatens to cause the existence or development of an unsafe condition in connection with the operation of the plant.
	(7) Results in conditions arising from natural or man-made events that affect or threaten to affect the safe operation of the plant.

ANNEX 4 TO SOP FOR US ARMY RADCON TEAM

TELEPHONE LIST

1. Finance and Accounting Officer, APG

Finance Officer	278-5111
Travel Section	278-2815
Cashier	278-4228

2. BRL Administrative Support Division, APG — 278-3511/2162

3. BRL Travel Office — 278-3695

4. Transportation Office — 278-3896
   Reservations — 278-3891

JNACC, Kirtland Air Force Base
AUTOVON 964-8287
COMMERCIAL (505) 264-8279

ARRCOM, Incident Investigation Team
Dover, NJ - AUTOVON 880-3205 (Mr. Carthage)

HQ, DARCOM
AUTOVON 284-9554/9610
COMMERCIAL (202) 274-9554/9610

Mr. Ralph J. Miller, Special Assistant for Nuclear Affairs, Nuclear Surety Office is the contact.

DARCOM Duty Officer
AUTOVON 284-9223
COMMERCIAL (202) 274-9223

Mrs. Pat Roberts	Office:	278-3511/2162
	Home:	838-7397
Mr. Alvan Hoffman	Office:	278-3682
	Home:	838-6577
Mr. David Rigotti	Office:	671-3509
	Home:	838-9183
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Team Members

Carl Crisco	838-5478
Richard A. Dunlop	272-3487
John M. Evans	838-7580
John R. Jacobson	838-7649
John W. Kinch	728-0930
John E. Kammerer	879-9674
J. Terrence Klopcic	838-7989
Joseph C. Maloney	592-7661
Richard A. Markland	658-6667
John H. McNeilly	838-5783
Richard D. Miller	676-9568
John A. Morrissey	836-2697
Ennis F. Quigley	823-7740
Albert E. Rainis	836-7717
David L. Rigotti	838-3983
John C. Saccenti	879-3374
Murray A. Schmoke	728-1124
R. Michael Schwenk	836-7240
Clifford Taylor	838-0348
E. Michael Vogel	734-6507
Edward F. Wilsey	838-5516

ANNEX 5 TO SOP FOR US ARMY RADCOM TEAM

STANDARD FORMS

Form Number	Title
RC-1	Notice of Alert
RC-2	Job Assignment ROSTER
RC-3	Schedule Summary
RC-4	On-Site Entrance
RC-5	Chronological Record of Events
RC-6	Film Badge Record
RC-7	Radioactive Sample Record Form
RC-8	Survey Record (Type A)
RC-9	Survey Record (Type B)
RC-10	Air Sample Record
RC-11	Polar Survey Analysis Form
RC-12	Focal Point Survey Analysis Form
RC-13	Bearing Analysis Form
RC-14	Instrumentation Reference Form
RC-15	Fidler Standardization
RC-16	Pocket Dosimeter Roster

RADCON TEAM LOG

NOTICE OF ALERT

1. General

(a) Date and Time called ____________________

(b) Called by ____________________

(c) Agencies Included ____________________

Team Only ____________

BRL Admin Spt Division ____________

APG Emergency Operations Center ____________

DARCOM ____________

JNACC ____________

Chief, VLD ____________

(d) Time Team Assembled or Departed ____________

2. Situation:

3. Recommendations:

Form RC-1
February 1979

OFFICIAL: ____________________
Name, Grade, or Title

RADCON TEAM LOG

JOB ASSIGNMENT ROSTER

Team Composition:

Position	Name and Grade	Notified (Date - Time)
Team Leader----------------		
Assistant Team Leader-----		
Health Physicist----------		
Decontamination Specialist		
Administrative Assistant--		
Monitor-------------------		
Monitor-------------------		
Equipment Specialist------		
Laboratory Technician-----		

(a) To accident site

(b) From accident site

OFFICIAL ____________________________
Name, Grade or Title

Form RC-2
February 1979

RADCON TEAM LOG

SCHEDULE SUMMARY

1. Date and Time:

   (a) Alert received____________________

   (b) Departed APG

      Advance Party____________________

      Team ____________________

   (c) Arrival at accident site

      Advance Party____________________

      Team ____________________

   (d) Relieved by NAICO____________________

   (e) Departed accident site____________________

   (f) Arrival at APG____________________

2. Advance Party Composition:

Position	Name and Grade
Team Leader	____________________
Monitor(s)	____________________
	____________________

OFFICIAL____________________

Name, Grade, or Title

Form RC-3
February 1979

RADCON TEAM LOG

O N - S I T E   E N T R A N C E

1. IDENTIFICATION OF ACCIDENT SITE, WITH PERTINENT DETAILS CONCERNING NATURE OF ACCIDENT.

2. RESPONSIBLE PERSONS AT ACCIDENT SITE:

NAICO: ____________________
Name, Rank/Organization

MEDICAL OFFICER: ____________________
Name, Rank/Organization

OTHER(   ): ____________________
Name, Rank/Organization

3. BRIEF OUTLINE OF OPERATION (TO INCLUDE HOURS OF OPERATION, SERVICES RENDERED, EQUIPMENT UTILIZED, AND INJURIES, ETC.)

OFFICIAL ____________________
Name, Grade or Title

Form RC-4
February 1979

RADCON TEAM LOG

Chronological Record of Events

Date and Time	EVENT

OFFICIAL____________________
Name, Grade or Title

CONTINUED ON PAGE________________

Form RC-5
February 1979

RADCON TEAM LOG

Film Badge Record

Name and Grade	Date	Film Badge No.

OFFICIAL ______________________
Name, Grade or Title

Form RC-6
February 1979

Date: __________

Time: __________

RADCON TEAM LOG

RADIOACTIVE SAMPLE RECORD FORM

A. IDENTIFICATION OF SAMPLE

1. Sample Number__________
2. Type: Air________ Water________ Soil_______ Wipe_______
   Other (specify)________________________________
3. Taken by (Name)________________________________
4. Taken from (Location)____________________________
   ____
5. Taken: Date (all)________ Time(all)________(air sample started)
   Date (air)________ Time(air)________Rate (cfm) (air)____
   Date (air)________ Time(air)________Rate (cfm) (air)____
   Date (air)________ Time(air)________Rate (cfm) (air)____
   Date (air)________ Time(air)________(air sample stopped)
6. Volume (cc) (air, water, soil) ____________________
7. Area (sq cm) (wipe) ____________________________

B. FIELD ANALYSIS OF SAMPLE

8. Date________________ Time________________ Place__________
9. Background count (cpm) ____________________________
10. Beta-gamma count (cpm) Gross______________ Net______________
11. Alpha count (dpm) Gross______________ Net______________
12. Contamination level ____________________________
13. Remarks:

C. LABORATORY ANALYSIS OF SAMPLE

14. Laboratory: Name ____________________________
    Address ____________________________
    ____
    ____
15. Date (all) ____________________________ Time (all)__________
    Date (air) ____________________________ Time (air)__________
    Date (air) ____________________________ Time (air)__________
16. Background count (cpm) ____________________________
17. Beta-gamma count (cpm) Gross__________ Net______________
18. Alpha count (dpm) First: Gross__________ Net______________
    Second: Gross__________ Net______________
    Third: Gross__________ Net______________
19. Contamination level ____________________________
20. Remarks:____________________________

OFFICIAL ____________________________
Name, Grade or Title

Form RC-7
February 1979

Page____of____Pages

RADCON TEAM LOG

SURVEY RECORD (TYPE A)

Date__________ Make__________ Sheet No.______
Counter Ser. No. __________
Monitor__________ **Probe Area __________ $cm^2 = A$

Time of Reading	Location of Reading	Meter Reading in c/m = R	*Meter Efficienty Factor = E	Pu Concentration $\mu g/m^2 = \frac{(R)x(E)}{(A)x14}$	Remarks

*E = 4 for PAC-3G(Gas Flow)
E = 2 for PAC-1SA

**A = 61 cm^2 for PAC-3G(AN/PDR-54)
A = 59 cm^2 for PAC-1SA(AN/PDR-60)

Form RC-8(HA)
February 1979

OFFICIAL______________________
Name, Grade or Title

RADCON TEAM LOG

SURVEY RECORD (TYPE B)

DATE__________ GRID REFERENCE: __________

TIME:__________

*1000 $\mu gm/m^2 \simeq$ ________ c/m

*3500 $\mu gm/m^2 \simeq$ ________ c/m

INST NO. ____________________

LOCATION (See Ref)	FIDLER* (c/m) α	PAC-1SA (c/m or mr/hr)	E-500 Series (mr/hr) β/γ	Remarks**

**Always note if soil sample has been taken at location where meter reading was taken.

Form RC-9(HA)
February 1979

OFFICIAL____________________
Name, Grade or Title

RADCON TEAM LOG

AIR SAMPLE RECORD

I. SAMPLE IDENTIFICATION

A. Location ______________________ Sample Number ______________

II. FIELD INFORMATION

A. Collection Data: Sample Serial Number: ______________

	Year	Month	Day	Time	Airflow (CFM)	Total Sample Period
Start Time:	____	_____	___	____	___________	
Stop Time:	____	_____	___	____	___________	_____ min.

B. Air Volume: $\underset{\text{Time (min)}}{\underline{\hspace{3cm}}} \times \underset{\text{Ave, Air Flow (CFM)}}{\underline{\hspace{3cm}}} = \underline{\hspace{2.5cm}}$ (ft^3)

C. Air Volume not known due to: 1.___Motor Failure 2.___Filter Failure 3.___Other

D. Time of Scan ____ Year _____ Month ___ Day ____ Time ______________ Time after Collection

E. Estimate not made due to: 1.___Survey meter failure 2.___Other

F. Field Estimate:

Sample $\underset{\text{Gross Alpha (CPM)}}{\underline{\hspace{3cm}}} - \underset{\text{Background (CPM)}}{\underline{\hspace{3cm}}} = \dfrac{\text{Net CPM} \times 10^{-10}}{\underset{\text{Air Vol (Ft}^3)}{\underline{\hspace{2cm}}}} = \underline{\hspace{2cm}}\ \mu\text{Ci/ml*}$

Sample: $\underset{\text{Gross Beta (mr/hr)}}{\underline{\hspace{3cm}}} - \underset{\text{Background (mr/hr)}}{\underline{\hspace{3cm}}} = \underset{\text{Net (mr/hr)}}{\underline{\hspace{2cm}}}$

Standard: $\underset{\text{Gross Beta (mr/hr)}}{\underline{\hspace{3cm}}} - \underset{\text{Background (mr/hr)}}{\underline{\hspace{3cm}}} = \underset{\text{Net (mr/hr)}}{\underline{\hspace{2cm}}}$

$$\frac{\underset{\text{Net sample}}{\underline{\hspace{3cm}}} \times \underset{\text{Activity of Standard}}{\underline{\hspace{3cm}}}\ (\mu\text{Ci})}{\underset{\text{Net Standard}}{\underline{\hspace{3cm}}} \times \underset{\text{Air Vol (ft}^3)}{\underline{\hspace{3cm}}} \times 2.83 \times 10^4} = \mu\text{Ci/ml}$$

G. External Gamma: ______________ (mr/hr)

*Applies to 4 inch diameter Whatman 41 filter paper for alpha measurement using a PAC-1SA Radiacmeter.

RADCON TEAM LOG

AIR SAMPLE RECORD (continued)

III. MPC VALUES OF INTEREST (Air)

PU-239 Insoluble Restricted Area 4×10^{-11} μCi/ml

Unrestricted Area 1×10^{-12} μCi/ml

If either the identity or the concentration of any radionuclide in a mixture is not known, the limiting values for purposes of Appendix B, CFR 10, Part 20 shall be

a. For purposes of restricted area: 6×10^{-12} μCi/ml
b. For purposes of unrestricted area: 2×10^{-14} μCi/ml

Form RC-10(HA)
February 1979

OFFICIAL ____________________
Name, Grade or Title

Page ____ of Pages ____

Date: ____________

RADCON TEAM LOG

POLAR SURVEY ANALYSIS FORM

TRANSIT/ISOCON & ISODOSE LINE DATE SHEET

IDENT OR STAKE NO.	AZ°	U	L	Δ	D	VA°	1000 $\mu g/m^2$	3500 $\mu g/m^2$	2 mr/h	True North NOTE:

KEY

AZ - Magnetic Azimuth
U - Upper Stadia Mark
L - Lower Stadia Mark
Δ - Upper Minus Lower Stadia
D - Distance (Range in Feet)
VA - Vertical Angle

Start Time: ________ HRS
Finish Time: ________ HRS

FORM RC-11(HA)
February 1979

OFFICIAL ____________________
Name, Grade or Title

RADCON TEAM LOG

FOCAL POINT SURVEY ANALYSIS FORM

METERS: α 1000 $\mu g(Pu)/m^2$ = ____________ c/m BKG = ____________ c/m

γ 3500 $\mu g(Pu)/m^2$ = ____________ c/m

BEARING TO FOCAL POINT (^{o})	STAKE NUMBER	Pu/γ	DISTANCE TO FOCAL POINT (FT)

DATE____________________

START TIME: ____________________

FINISH TIME: ____________________

OFFICIAL____________________
Name, Grade or Title

FORM RC-12(HA)
February 1979

Page____of ____Pages

Date:______________

RADCON TEAM LOG

BEARING ANALYSIS FORM

UPWIND BEARING TO GZ*_____

DISTANCE TO ISOCON/ISODOSE LINES

RELATIVE BEARING	BEARING** TO GZ	1,000 $\mu g\,^{239}Pu/m^2$ (ft)	3,500 $\mu g\,^{239}Pu/m^2$ (ft)	2mr/hr (ft)
45				
90				
135				
180				
225				
270				
315				
360				

* Angles in degrees, magnetic

** Bearing to GZ = upwind bearing + relative bearing

Reference Point:

Diagram { }

FORM RC-13(HA)
February 1979

OFFICIAL______________________
Name, Grade or Title

Date: ____________________

RADCON TEAM LOG

INSTRUMENTATION REFERENCE FORM

ALPHA

PRM-5-3 SERIAL NO. _________ (Elect.); PROBE: ☐ 5 inch-Be Window: SN ______

☐ PG2 Low-E Gamma: SN ______ ☐ SPA-3 Scintillation: SN ______

CHECK SOURCE (SN. ______) PHA __________ NET C/M (Surface Contact)
GROSS __________ NET C/M (Surface Contact)

STANDARDIZATION:

PHA MODE (_____ KeV Window, HV ______ Channel)
____________ Net C/M (1000μgmPu/M^2 @ 1 ft)
____________ Net C/M (   )

BACKGROUND ____________________ C/M

ALPHA AN/PDR-60

PAC-1SA(GA): Serial No. __________ (Elect.); P

PROBE: ☐ Alpha Probe (59cm^2 Surface Area) AC-3

☐ PG-1 (NaI Scintillation Xtal) SN ______

☐ RASP-1 (   ) SN ______

STANDARDIZATION:

Alpha Probe: Soil 170,000 c/m (1000μgmPu/M^2 Surface)
Concrete 200,000 c/m (1000μgmPu/M^2 Surface)
PG-1 Probe: Specify Setup:

BETA/GAMMA

E-500 Series

Check Source: ____________ READING VERIFIED: __________

WEATHER CONDITIONS:

____

MONITOR(S): ____________________ SIGN ____________________ SIGN

FORM RC-14
February 1979

OFFICIAL ____________________
Name, Grade or Title

RADCON TEAM LOG
FIDLER STANDARDIZATION

DATE:______________

FIDLER PROBE

STANDARDIZATION

HV Channel No.__________
Electronics SN.__________
Type:__________

Standard No.__________

PHA Count Rate:__________ c/m Surface Contact
Gross Count Rate:__________ c/m Surface Contact

Calibration:* ______Inch Xtal Probe No.______
______cm from surface plane

Count Rate (c/m)	Radial Distance (cm)
______	0
______	5
______	10
______	15
______	20
______	25
______	30
______	35
______	40
______	45
______	50

Background:__________c/m

Certified Standard
No.__________

Type:__________

Activity:__________**ntps(Q_o), or
Activity:__________µCi
Date:__________

Current Activity (See Page 2)

Q = __________**ntps, or

= __________µCi

Energy: __________keV

Abundance: __________Percent

A_b = ______%/100= 0.______

Half-Life:__________(yrs,min,sec)

$t_{lapse} \approx$ __________Seconds

Continued on Page 2

*Reference: FM 3-15 Insert article by J.F. Tinney
**Consider only if micro-curie strength is unknown.

FORM RC-15
February 1979

OFFICIAL__________________
Name, Grade or Title

FIDLER STANDARDIZATION
(Continued---)

Q = ______ntps; ______ntps X ______* (A_b) = ______d/s

= ______d/m (______μCi-Am^{241} ≃ ______μCi-Pu Based on Pu/Am Ratio______)

$$S_A = \frac{.00628}{Q} \times \left\{ \_\_\_\_ \times .05 + \_\_\_\_ \times .15 + \_\_\_\_ \times .25 + \_\_\_\_ \times .35 + \_\_\_\_ \times .45 + \_\_\_\_ \times .55 \right\} \times 100$$

S_A = ______ $\frac{(c/m)\ M^2}{\text{micro-gm}}$; S_A^{-1} = ______ $\frac{\text{micro-gm}}{(c/m)\ M^2}$

Specific Activity of Pu-239; Therefore:______μCi Pu = ______μgm Pu
0.062 μCi/μgm

Therefore: ______c/m = 1000μgm Pu/M^2

______c/m = 3500μgm Pu/M^2

CALCULATE CURRENT ACTIVITY

Q = $Q_o e(0.693/T_{1/2})$ (t-lapse)

Q = _____$e^{(0.693/________\text{sec})\ (____\text{sec})}$

Q = __________ntps, or

Q = __________μCi

*NOTE: A_b is frequently equal to 1 when the standard being used is the same as the isotope being surveyed.

DATE ________________

RADCON TEAM LOG

POCKET DOSIMETER ROSTER

Name	Dosimeter Range	Serial No.	Reading		Period (HRS)
			Initial	Final	

FORM RC-16
February 1979

OFFICIAL ________________
Name, Grade or Title

APPENDIX B

US ARMY RADCON TEAM INVENTORY

The following pages list the equipment and supplies which are necessary for the RADCON Team to accomplish its various missions. It should be noted that this inventory is far in excess of that which is recommended by pertinent regulations. However, extensive experience has mandated that such an inventory be maintained. It is presented here so that similar emergency response teams can be made aware of the extent of such an inventory.

INSTRUMENT CASE 1 (I-1)

FIDLER/PG-2/SPA-3 ;KEY #2165

FIDLER-Type 20SHB63K/5Q-21X, SN 974 (EK 207R5)
- -Height Bracket
- -Plastic Collar, 2-Halves
- -Performance Data Sheet

PG-2 -Low Energy Gamma Detector, SN 974

SPA-3 -Scintillation Probe Assembly, SN 974

Pulse Rate Meter, Model PRM-5, SN 974
- -Battery, 1.5V, D Cell (5)
- -Detector Cable
- -Carrying Strap

Speaker, Model SK-1
- -Battery, 15V Photoflash, NEDA 220 (#504)
- -Speaker Cable

INSTRUMENT CASE 2 (I-2)

FIDLER/PG-2/SPA-3 ;KEY #2673

FIDLER-Type 20SHB63K/5Q-21X, SN 2807 (HV 483)
- -Height Bracket
- -Plastic Collar, Full Circle
- -Aluminum Collar, Full Circle
- -Aluminum Collar, 2-Halves
- -Performance Data Sheet

PG-2 -Low Energy Gamma Detector, SN 2807
SPA-3 -Scintillation Probe Assembly, SN 2807

Pulse Rate Meter, Model PRM-5-3, SN 2807
- -Battery, 1.5V, D Cell (5)
- -Detector Cable
- -Carrying Strap
- -Technical Manual

Speaker Box, Model SK-1
- -Battery, 15V Photoflash, NEDA 220 (#504)
- -Speaker Cable

Screw Driver, Jewler's

INSTRUMENT CASE 3 (I-3)

FIDLER/PG-2/SPA-3 ;KEY #2050

FIDLER-Type 20SHB63K/5Q-21X, SN 2805 (HY 868)
- -Height Bracket
- -Aluminum Collar Full Circle
- -Aluminum Collar 2-Halves
- -Performance Data Sheet

PG-2 -Low Energy Gamma Detector, SN 2805

SPA-3 -Scintillation Probe Assembly, SN 2805

Pulse Rate Meter, Model PRM-5-3, SN 2805
- -Battery, 1.5V, D Cell
- -Detector Cable
- -Carrying Strap

Speaker Box, Model SK-1
- -Battery, 15V Photoflash, NEDA 220 (#504)
- -Speaker Cable

INSTRUMENT CASE 4 (I-4)

FIDLER/PG-2/SPA-3 ;KEY #2667

FIDLER-Type 20SHB63K/5Q-21X, SN 2806 (HY 867)
- -Height Bracket
- -Aluminum Collar Full Circle
- -Aluminum Collar 2-Halves
- -Performance Data Sheets

PG-2 -Low Energy Gamma Detector, SN 2806

SPA-3 -Scintillation Probe Assembly, SN 2806

Pulse Rate Meter, Model PQM-5-3, SN 2806
- -Battery, 1.5V, D Cell (5)
- -Detector Cable
- -Carrying Strap

Speaker, Model SK-1
- -Battery, 15V Photoflash, NEDA 220 (#504)
- -Speaker Cable

INSTRUMENT CASE 5 (I-5)

PAC-1SA/RASP-1/PG-1 ;KEY #2364

Alpha Probe (AC-3) SN 1648

Alpha Scintillation Probe, Ruggedized (RASP-1) SN 1648

Plutonium Gamma Probe, (PG-1) SN 1648

Portable Alpha Counter, Model PAC-1SAGA, SN 1648
- -Battery, 1.5V, D Cell (5)
- -Detector Cable
- -Carrying Strap

Speaker, Model SK-1
- -Battery, 15V Photoflash, NEDA 220 (#504)
- -Speaker Cable

Cold Weather Pack
- -Battery, 1.5V, D Cell (5)
- -Electric Cord
- -Carrying Strap

INSTRUMENT CASE 6 (I-6)

PAC-1SA/RASP-1/PG-1 ;KEY #2286

Alpha Probe (AC-3) SN 365

Alpha Scintillation Probe, Ruggedized (RASP-1) SN 365

Plutonium Gamma Probe, (PG-1) SN 365

Portable Alpha Counter, Model PAC-1SAGA SN 365
- -Battery, 1.5V, D Cell (5)
- -Detector Cable
- -Carrying Strap

Speaker, Model SK-1
- -Battery, 15V Photoflash, NEDA 220 (#504)
- -Speaker Cable

Cold Weather Pack
- -Battery, 1.5V, D Cell (5)
- -Electric Cord
- -Carrying Strap

INSTRUMENT CASE 7 (I-7)

PAC-1SA/RASP-1/PG-1 ;KEY #2060

Alpha Probe (AC-3) SN 738

Alpha Scintillation Probe, Ruggedized (RASP-1) SN 738

Plutonium Gamma Probe (PG-1) SN 738

Portable Alpha Counter, Model PAC-1SAGA SN 738
- -Battery, 1.5V, D Cell (5)
- -Detector Cable
- -Carrying Strap

Speaker, Model SK-1
- -Battery, 15V Photoflash, NEDA 220 (#504)
- -Speaker Cable

Cold Weather Pack
- -Battery, 1.5V, D Cell (5)
- -Electric Cord
- -Carrying Strap

INSTRUMENT CASE 8 (I-8)

PAC-1SA/RASP-1/PG-1 ;KEY #2122

Alpha Probe (AC-3) SN 128

Alpha Scintillation Probe, Ruggedized (RASP-1) SN 128

Plutonium Gamma Probe (PG-1) SN 128

Portable Alpha Counter, Model PAC-1SAGA SN 128
- -Battery, 1.5V, D Cell (5)
- -Detector Cable
- -Carrying Strap

Speaker, Model SK-1
- -Battery, 15V Photoflash, NEDA 220 (#504)
- -Speaker Cable

Head Set

Cold Weather Pack
- -Battery, 1.5V, D Cell (5)
- -Electric Cord
- -Carrying Strap

INSTRUMENT CASE 9 (I-9)

E-520/HP-177/HP-210 ;KEY #2386

Beta-Gamma Hand Probe (HP-177) SN 651

Pancake Detector (HP-210), RADCON-7, SN 651

Pancake Detector (HP-210), RADCON-8, SN 651

Geiger Counter, Model E-520, SN 651
- -Battery, 1.5V, D Cell (2)
- -Detector Cable
- -Carrying Strap

Speaker, Model SK-1
- -Battery, 15V Photoflash, NEDA 220 (#504)
- -Speaker Cable

INSTRUMENT CASE 10 (I-10)

E-520/HP-177/HP-210 ;KEY #2349

Beta-Gamma Hand Probe (HP-177) SN 650

Pancake Detector (HP-210), RADCON-5, SN 650

Pancake Detector (HP-210), RADCON-6, SN 650

Geiger Counter, Model E-520, SN 650
- -Battery, 1.5V, D Cell (2)
- -Detector Cable
- -Carrying Strap

Speaker, Model SK-1
- -Battery, 15V Photoflash, NEDA 220 (#504)
- -Speaker Cable

Calibration Sheets (All Sets)

INSTRUMENT CASE 11 (I-11)

PIC-6A/E-500/HP-177

Portable Ion Chamber, Model PIC-6A, SN 457
- Battery, 9V (2)

Portable Ion Chamber, Model PIC-6A, SN 458
- Battery, 9V (2)

Geiger Counter, Model E-500B, SN 585
- Battery, 1.5V, D Cell (5)

Beta-Gamma Hand Probe (HP-177)

Speaker, Model SK-1
- Battery, 15V Photoflash, NEDA 220 (#504)
- Speaker Cable

Instrument Cases 12(I-12) through case 22(I-22) contain the same Radiac instrument sets as cases 1(I-1) through 11(I-11) except for serial and key numbers.

Suitcase (S-0)

C.B. Transceivers	EA	4
Optical Tape Measure, 6-100 ft	EA	2
Optical Tape Measure, 50-600 ft	EA	2
Optical Tape Measure, 50-1000 yds	EA	1
Windmeter	EA	1
1.5 V Dry Cell BA58/NBA58 (AA)	EA	40
Cable & Adaptor Optical Tape Measure	EA	2
Lensmatic Compass	EA	2

Suitcase (S-1)

Book, Radiological Safety Handbook	EA	1
Book, Radiological Safety Handbook Supplm't 456 Jan 77	EA	1
Book, Radiological Health Handbook Pam. 25	EA	1
Book, Fundamentals of Nuclear Radiation & Radic Instr	EA	1
Book, Part 20 Stc, For Protection Against Radiation	EA	1
Book, Mechanical Engineering Handbook	EA	1
Book, Nuclear Accident Contamination Control FM-3-15	EA	1
Note book, Ruled Bound	EA	2
Pads, Ruled 8X10&1/2	EA	2
Lables, Gummed	PK	1
Correction Tape	BX	1
Protractor, 6"	EA	1
Protractor, 10"	EA	1
Triangle, 45 degrees	EA	1
Triangle, 30-60 degrees	EA	1
Graph Paper, Assorted	BX	6
Felt Tip Marker, Assorted Colors	EA	12
Felt Tube Marker, Assorted Colors	EA	12
Pencils, Pens, Grease Pencils, Assorted	BX	1
Marker Indelible, Black	EA	1
Envelopes, 2&1/2X4	EA	25
Envelopes, 4X9	EA	12
Envelopes, 6&1/2X9&1/2	EA	6
Envelopes, 8&1/2X11	EA	3
Envelopes, 12X14	EA	3
Stapler, Std.	EA	1
Staples, Std.	BX	1
Paper Clips	BX	1
Thumb Tacks	BX	1
Razor Blades, Single Edge	BX	1
Scissors, 12"	EA	1
Ruler, Plastic See-Thur 12"	EA	2
Tie on Tags 2X3 and 3X5	PK	1
Scotch Tape Dispensor & Tape	EA	1
Masking Tape, 2"	RL	1
Masking Tape, 1&1/2"	RL	1
Masking Tape, 1"	RL	1

Suitcase (S-1) (cont'd)

Masking Tape, 3/4"	RL	1
Filament Tape, 1/2"	RL	1
Folder, Manila, Std.	EA	6
Eraser, Pencil	EA	2
Kimwipes or Equal	BX	1

Suitcase (S-2)

Book, Radiological Safety Handbook	EA	1
Book, Radiological Safety Handbook Supplm't 456, Jan 77	EA	1
Book, Radiological Health Handbook Pam. 25	EA	1
Book, Fundamentals of Nuclear Radiation & Radic Instr	EA	1
Book, Part 20 Std. For Protection Against Radiation	EA	1
Book, Mechanical Engineering Handbook	EA	1
Book, Nuclear Accident Contamination Control FM-3-15	EA	1
Note Book, Ruled Bound EA	EA	2
Pads, Ruled 8X10&1/2	EA	2
Lables, Gummed	PK	1
Correction Tape	BX	1
Protractor, 6"	EA	1
Protractor, 10"	EA	1
Triangle, 45 degrees	EA	1
Triangle, 30-60 degrees	EA	1
Graph Paper, Assorted	BX	6
Felt Tip Marker, Assorted Colors	EA	12
Felt Tube Marker, Assorted Colors	EA	12
Pencils, Pens, Grease Pencils, Assorted	BX	1
Marker Indelible, Black	EA	1
Envelopes, 2&1/2X4	EA	25
Envelopes, 4X9	EA	12
Envelopes, 6&1/2X9&1/2	EA	6
Envelopes, 8&1/2X11	EA	3
Envelopes, 12X14	EA	3
Stapler, Std.	EA	1
Staples, Std.	BX	1
Paper Clips	BX	1
Thumb Tacks	BX	1
Razor Blades, Single Edge	BX	1
Scissors 12"	EA	1
Ruler, Plastic See-Thru 12"	EA	2
Tie on Tags, 2X3 and 3X5	PK	1
Scotch Tape Dispensor & Tape	EA	1
Masking Tape, 2"	RL	1
Masking Tape, 1&1/2"	RL	1
Masking Tape, 1"	RL	1
Masking Tape, 3/4"	RL	1
Filament Tape 1/2"	RL	1
Folder Manila, Std.	EA	6
Eraser, Pencil	EA	2
Kimwipes or Equal	BX	1

Foot Locker (AS-1)

Air Sampler, RADCON #1	
Air Sampler, RADCON #2	
Air Sampler, RADCON #3	
Air Sampler, RADCON #4	
Tripods	4EA
Directions	2
Base Plates	4
Thumb Screws for Tripods	12EA
Filter Paper, #41	2BX
Extention Cords, #16/3 Wire	3
Clipboards	4
Air Sampling Forms	5
Holder	1

Foot Locker (AS-2)

Air Sampler, RADCON #5	
Air Sampler, RADCON #6	
Air Sampler, RADCON #7	
Air Sampler, RADCON #8	
Tripods	4EA
Directions	2
Base Plates	4
Thumb Screws for Tripods	12EA
Filter Paper, #41	2BX
Extention Cords, #16/3 Wire	2
Extention Cord, Orange, #16/2 Wire, With Ground	1
Clipboards	4
Air Sampling Forms	5

Foot Locker (AS-3)

Filter Holder, 7"X9"	1
Filter Holder, 8.1"X5.2"	2
#1 Filter Paper, 24 cm Di	1PK
Filter Paper, Rectangular	1GP
Filter Paper, 8"X10"	4PK
Filter Paper Holder, "JET VENTURI"	2
Filter Paper, TFA 69, 6"X 9"	1PK
Filter Paper, TFA 41	13
Staplex Air Samplers	18PT
Rubber Covers for Staplex Inlets	8

Footlocker #1 (F-1)

Clipboard, Std. Size	EA	4
Grid Data Sheets Form RAD-10	EA	20
Optical Level	EA	1
Thermometer	EA	1
Stakes, Grid Pink 3/8X3/8X12 With 1/2 Point	EA	130
Stakes, Grid Red 3/8X3/8X12 With 1/2 Point	EA	30
Stakes, Grid Yellow 3/8X3/8X12 With 1/2 Point	EA	30
Stakes, Grid White 3/8X3/8X12 With 1/2 Point	EA	20
Stakes, Hot Line 3/8X1X29 With 1/2 Point	EA	60
Stakes, Ground Zero 3/8X1X29 With 1/2 Point	EA	5
Hammer, Carpenters	EA	4
Utility Bag	EA	5
Engineering Tape, Cloth	YD	200
Marking Crayon	EA	6
Isodose Data Sheets Form RAD-15	EA	4
Pad, Ruled 8X10&1/2	EA	1
Plastic Bags, 23X17X48	EA	30
Plastic Bags, 10X8X22	EA	40
Plastic Bags, 16X8	EA	100
Plastic Bags, Zip Loc	PK	1
Plastic Bags, Trash	EA	15
Paper Pads, Runway 3X12	EA	1
Paper Pads, Instr. 3X3	EA	1
Paper Pads, Monitor 3X6	EA	1
Paper Pads, Lay Down 3X6	EA	1
Masking Tape, 2"	RL	4
Masking Tape, 3/4"	RL	4
Hand Towels	PK	1
Belt, Utility	EA	4
Tape, Measure, 100 m	EA	1
Kit, First Aid	EA	1
Kit, Snake Bite	EA	1
Repellant, Insect	CN	2
Knife, Razor-Disposable	EA	1
Knife, Putty	EA	1
Scoop, Laboratory	EA	1
Cord, Construction	BL	1
Wisk Broom, Small	EA	1

Footlocker #2 (F-2)

Clipboard, Std. Size	EA	4
Grid Data Sheets Form RAD-10	EA	20
Optical Level	EA	1
Thermometer	EA	1
Stakes, Grid Pink 3/8X3/8X12 With 1/2 Point	EA	130
Stakes, Grid Red 3/8X3/8X12 With 1/2 Point	EA	30
Stakes, Grid Yellow 3/8X3/8X12 With 1/2 Point	EA	30
Stakes, Grid White 3/8X3/8X12 With 1/2 Point	EA	20
Stakes, Hot Line 3/8X1X29 With 1/2 Point	EA	60
Stakes, Ground Zero 3/8X1X29 With 1/2 Point	EA	5
Hammer, Carpenters	EA	4
Utility Bag	EA	5
Engineering Tape, Cloth	YD	200
Marking Crayon	EA	6
Isodose Data Sheets Form RAD-15	EA	4
Pad, Ruled 8X10&1/2	EA	1
Plastic Bags, 23X17X48	EA	30
Plastic Bags, 10X8X22	EA	40
Plastic Bags, 16X8	EA	100
Plastic Bags, Zip Loc	PK	1
Plastic Bags, Trash	EA	15
Paper Pads, Runway 3X12	EA	1
Paper Pads, Instr. 3X3	EA	1
Paper Pads, Monitor 3X6	EA	1
Paper Pads, Lay Down 3X6	EA	1
Masking Tape, 2"	RL	4
Masking Tape, 3/4"	RL	4
Hand Towels	PK	1
Belt, Utility	EA	4
Tape, Measure, 100 m	EA	1
Kit, First Aid	EA	1
Kit, Snake Bite	EA	1
Repellant, Insect	CN	2
Knife, Razor-Disposable	EA	1
Knife, Putty	EA	1
Scoop, Laboratory	EA	1
Cord, Construction	BL	1
Wisk Broom, Small	EA	1

General Stock

Clipboard Std. Size	EA	24
Ribbon, Marking Red	RL	6
Ribbon, Marking White	RL	6
Ribbon, Marking Yellow	RL	6
Ribbon, Marking Pink	RL	6
Stakes Grid, 3/8X3/8X12 With 1/2 Point	EA	500
Stakes Generak, 3/8X1X29 With 1/2 Point	EA	120
Grid Data Sheets Form RAD-10	EA	100
Thermometer	EA	2
Hammer, Carpenters	EA	10
Utility Bag	EA	20
Engineering Tape, Cloth	YD	1000
Marking Crayon	EA	12
Isodose Data Sheets Form RAD-15	EA	100
Pads, Ruled 8X10&1/2	EA	24
Plastic Bags, 23X17X48	EA	250
Plastic Bags, 10X8X22	EA	250
Plastic Bags, 16X8	EA	500
Plastic Bags, Zip-Loc	PK	10
Plastic Bags, Trash	EA	200
Paper Pads, Runway 3X12	EA	6
Paper Pads, Instr. 3X3	EA	6
Paper Pads, Monitor 3X6	EA	6
Paper Pads, Laydown 3X6	EA	6
Masking Tape, 2"	RL	24
Masking Tape, 3/4"	RL	24
Hand Towels	PK	10
Belt, Utility	EA	8
Tape Measure, 100 m	EA	2
Kit, First Aid	EA	3
Kit, Snake Bite	EA	3
Repellant, Insect	CN	24
Knife, Razor-Disposable	EA	10
Knife, Putty	EA	10
Scoop, Laboratory	EA	10
Cord, Construction	BL	24
Wisk Broom, Small	EA	6
Felt Tip Marker, Assorted Color	EA	24
Felt Tube Marker, Assorted Color	EA	24
Pencils	BX	2
Pens	BX	2
Grease Pencils	BX	2
Marker, Indelible Black	BX	2
Envelopes, 4X9	EA	100
Envelopes, 12X14	EA	25
Stapler, Standard	EA	4
Staples, Standard	BX	2
Paper Clips	BX	2

General Stock (cont'd)

Thumb Tacks	BX	10
Razor Blades, Single Edge	BX	4
Scissors, 12 inch	EA	4
Ruler, 12 inch Plastic See-Thru	EA	10
Tie on Tags, 2X3	PK	50
Tie on Tags, 3X5	PK	50
Masking Tape, 1&1/2"	RL	24
Masking Tape, 1"	RL	24
Filament Tape, 1/2"	RL	24
Folder, Manila Std.	EA	10
Eraser, Pencil	EA	10
Kimwipes	BX	25
Lensmatic Compass	EA	2
Batteries, D-Cell 1.5V	EA	240
Batteries, #504	EA	24
Batteries, AA 1.5V	EA	24
Batteries, 9V	EA	18

APPENDIX C

BIOGRAPHICAL SKETCHES OF RADCON TEAM MEMBERS

Contained herein are biographical sketches of the members of the US Army RADCON Teams. As discussed in section 1.2 of the basic report, all of the personnel are members of the staff of the Ballistic Research Laboratory. This is due, in no small part, to a series of past organizational changes which have occurred. In any event, the end result has been the assemblage of a group of people who possess a wide range of unique capabilities. In fact, it is doubtful that any other team of this type has such overall capabilities. It should be noted that these capabilities have proven invaluable in accomplishing the variety of tasks which have been imposed upon us. Further, such capabilities have ensured unparalleled flexibility in meeting any radiological emergency.

David L. Rigotti

Mr. David L. Rigotti is the Chief, Radiation Engineering Branch, Vulnerability/Lethality Division, BRL. He received his BS degree from the Michigan Technological University in 1950 and has done considerable post graduate work. During the period 1951 - 1970 he held various managerial positions in the Chemical Research and Development Laboratory and the US Army Nuclear Defense Laboratory. Although in recent years he has directed efforts in the development and application of methodologies used in assessing the vulnerability of military materiel to laser radiation and conventional weaponry, his primary area of expertise has been in Nuclear Weapons Effects Research. He has served as a project officer for a number of projects conducted at Nuclear Weapons Tests in the Pacific Proving Ground and the Nevada Test Site. He has made invaluable contributions to the development and application of gamma and neutron spectroscopy techniques used in the laboratory as well as at Nuclear Weapons Tests. His pioneering efforts in these areas were responsible for his chairing or serving on a number of Army and DOD panels/committees which were responsible for establishing and directing vital DOD research and development in these areas. He was also responsible for establishing the Army's R&D program in what later was assigned the code name HAVENAME. He was the Test Director of the first Tri-service field test involving this phenomena and was later appointed Deputy Project Manager, Project HAVENAME. He has been responsible for, and has been a member of, the US Army RADCON Teams since their creation.

John H. McNeilly

Mr. John H. McNeilly is the Team Leader of the Thermomechanical Vulnerability Team, Radiation Engineering Branch, Vulnerability/Lethality Division, BRL. He received his BS in Chemistry degree from MIT in 1955 and, after completing the Chemical Officers Basic Course, was assigned to the Radiological Division of the Chemical Warfare Laboratories in the fall of 1955. From the period 1955 to 1970 he participated (often as a project officer) in a number of nuclear weapon effects test programs. These projects included radiochemical analysis of fallout samples, induced activity in soil, aerial survey, neutron and gamma-ray passive dosimetry, the development of ferroelectric radiation detectors, and the measurement of neutron spectra as a function of time. Since 1970 he has been primarily active in the area of high energy laser lethality, especially in the areas of lethality assessment methodology development and generating an experimental data base for system component failures. Throughout his career he has been responsible for developing new and/or improved measuring techniques in the case of radiological measurements or pioneering the development of vulnerability/lethality assessment methodologies for new kill mechanisms. He has been a team leader of one of the US Army RADCON Teams since their creation.

John W. Kinch

Mr. John W. Kinch is a member of the Radiation Engineering Branch, Vulnerability/Lethality Division, Ballistics Research Laboratory. He received his BS degree form the Lock Haven State College in 1952 and has done graduate work at the Pennsylvania State University. He was employed in the field of nuclear weapon effects by the Chemical Research and Development Laboratory and the US Army Nuclear Defense Laboratory during the period from 1952 to 1970. During that time, he participated in essentially all atmospheric nuclear tests, both at the Nevada Test Site and Pacific Sites and many of the DoD sponsored underground effects experiments. He has served as project officer for several major projects and is considered an expert in the field of neutron measurement. He also managed several major instrumentation development efforts that led to new and improved instruments for neutron measurements during high altitude tests. In more recent years, he has been interested in the application and development of computer methodologies to obtain nuclear and conventional vulnerability information.

John R. Jacobson

Mr. John R. Jacobson is the leader of the Nuclear Vulnerability Team of the Radiation Engineering Branch, Vulnerability/Lethality Division, BRL/ARRADCOM. He majored in chemistry at the University of Wisconsin and received his BS degree in 1956. Since that time, he has done both undergraduate and graduate work at the Universities of Washington and Delaware. His career during the period 1956 to 1970 was centered in the fields of nuclear radiation detection and measurement, health physics, and nuclear weapons effects. In the late 1950's he was employed as a radiation specialist (health physicist) at the Hanford Atomic Products Operation and in 1963 joined the staff of the US Army Nuclear Defense Laboratory where he served as project officer on a variety of underground nuclear weapons effects tests at the Nevada Test Site. During this time, he conducted research in the areas of neutron effects on gamma dosimetry, dose rate effects on gamma dosimetry and neutron spectroscopy. He also developed a procedure to measure neutron fluence by means of neutron radiograph film densities. He has served as a radiation dosimetry consultant to many other government agencies and laboratories. In addition, he was an active member of several ASTM subcommittees dealing with neutron and gamma dosimetry. Since 1970 Mr. Jacobson has been involved in radiation shielding experiments and studies designed to identify the nuclear shielding characteristics of military vehicles. He is the Chairman of the BRL Radiation Protection Committee and an assistant RADCON Team Leader.

Joseph C. Maloney

Mr. Joseph C. Maloney received a Bachelor of Engineering degree in mechanical engineering from The Johns Hopkins University in 1943. Following service in the US Navy, he spent several years in the electrical manufacturing industry and entered nuclear research in 1949. During the following thirty year period, he has been a principal investigator/project officer in the same organization (albeit with many reorganizations and laboratory name changes). Although his principal field has been decontamination, he has also participated in shielding, thermal, initial radiation, and fallout projects in the laboratory, at atmospheric nuclear tests and at field nuclear simulation tests. Major efforts he directed were the Camp McCoy decontamination project of eight years seasonal duration, and the air sampling project of Operation ROLLER COASTER, a series of non-nuclear detonations of nuclear devices in accident situations. He has been a member of the RADCON Team since its inception in 1958, and has been team leader for the past ten years.

J. Terrence Klopcic

Dr. J. Terrence Klopcic is a research physicist with the Radiation Engineering Branch, Vulnerability/Lethality Division, BRL. Dr. Klopcic received his Ph.D. in Physics from the University of Notre Dame in 1970, where he designed, built, and conducted a successful experiment to measure the angular distribution and polarization of neutrons from the (three-body) reaction ^3H (^2He,n) ^5Li. The project involved mathematical modeling of detection processes; the design and construction of solid, liquid, and high pressure (3000 psi) gas scintillation detectors; and nanosecond electronic logic circuitry. Since joining the BRL as an Army officer (1970) and civilian (1972), Dr. Klopcic has worked primarily as a systems and vulnerability analyst. Methodologies and several large supporting computer codes were developed by him in the areas of laser vulnerability and unit-level residual combat capability. However, he was also involved in research aimed toward the understanding, modeling, and development of ferroelectric detectors and a ferroelectric sensed neutron calorimeter. Dr. Klopcic has also developed large-computer utility programs in the areas of data manipulation, fitting, and 3-D plotting which have been applied to RADCON problems.

Edward F. Wilsey

Mr. Edward F. Wilsey is a staff member of the Radiation Engineering Branch, Vulnerability/Lethality Division of BRL. He received the degree of Bachelor of Science in Chemistry from Ohio University in 1948. He has held positions as Chemist, Physicist, and Physical Scientist in various organizations at the Army Chemical Center, Edgewood Arsenal, and Aberdeen Proving Ground. Mr. Wilsey's major experience has been in fallout, aerosol, and dust sampling at atmospheric nuclear weapon tests. He also has had experience in the assessment of radiation hazards from fallout and neutron-induced radioactivity in soils, radiochemical analyses of fission products, hazard assessment from the use of depleted uranium ammunition, and studies on nuclear weapon effects, particularly in residual radiation. He has worked with and modified computer programs designed to predict fallout. Mr. Wilsey has served as a staff member or project officer for eleven field projects planned or conducted at atmospheric nuclear weapon tests from 1951 to 1963. He has also served on the Defense Atomic Support Agency Panel on Neutron-Induced Activity in soils and the Joint Technical Coordinating Group for Munitions Effectiveness Ad Hoc working Group on Depleted Uranium Munitions. He has written many technical reports and has been a member of the RADCON Team since 1969.

Ennis F. Quigley

Dr. Ennis F. Quigley is a research physicist in the Radiation Engineering Branch, Vulnerability/Lethality Division, Ballistic Research Laboratory. He received his BS degree (Physics) from Loyola College, his MS degree (Physics) from the Johns Hopkins University in 1965, and his Ph.D. degree (Mechanical and Aerospace Engineering) from the University of Delaware in 1976. His areas of interest are in heat transfer and solid mechanics; and, since 1967, he has been engaged in studies on the effects of nuclear thermal radiation and nuclear air blast on materials and systems. He has been chairman of the AMC subcommittee on nuclear thermal radiation effects and a US member of Panel N-2 of The Technical Cooperation Program. Since 1975, he has been a member of the US Army RADCON Team.

John M. Evans

Mr. John M. Evans is currently employed at the US Army Ballistic Research Laboratory as a Research Physicist, with a Bachelor of Science Degree from Towson State University. He has been an independent investigator and a team leader, pursuing investigations connected with both the experimental and analytical aspects of several areas of research. Included in these areas are low-energy laser propagation, laser vulnerability measurements and analysis, and state-of-the-art optical systems design and development. Since November 1975, Mr. Evans has had responsibility for the BRL laser effects and vulnerability experimental program. This effort includes the design of the test plans, conduction and coordination of tests at various laser facilities. He is responsible for the supervision of the test teams at the test site and acts as consultant to many other DOD organizations planning vulnerability tests and programs. He also has the responsibility for the nuclear-thermal experimental program and analyses using solar furnaces and other nuclear-thermal facilities.

John E. Kammerer

Mr. John E. Kammerer is a Physical Scientist at the Vulnerability/Lethality Division of the Ballistic Research Laboratory which is one of the Army Armament Research and Development Command Laboratories engaged in basic and applied research for designing and analyzing Army weapon systems. Mr. Kammerer received his B.S. in Physics from Gettysburg College in 1954 and was employed by the Bendix Aviation Corp., Baltimore, MD from 1954 to 1960 where he worked on airborne meteorological instrumentations and receivers. During 1960 he was employed by the Martin Company, Baltimore, MD, where he concentrated on finalizing PERSHING countdown logic and testing TITAN ground support equipment. Since 1961 he has been employed by the Ballistic Research Laboratory, Aberdeen Proving Ground, MD. From 1961 through 1975 he was engaged in millimeter wave research of the near earth using radar and radiometric techniques to study and define target signatures, clutter, multipath, attenuation, reflection coefficients, camouflage, and weather effects at 35, 70, 95 and 140 GH_z. Since 1976 he has been involved in the performance of high energy laser vulnerability field experiments of critical components, computerized reduction of these data through analysis of beam diagnostics, mathematical modeling of vulnerability data to develop predictive equations defining the penetration process, and construction of combinatorial geometry descriptions. Mr. Kammerer was appointed to the US Army RADCON Team in February 1978.

John C. Saccenti

Mr. John C. Saccenti has directed, researched, developed, and applied radiation technology in its relevance in programs ranging from high altitude and underground test measurements, to reactor studies, health physics applications, and radiation transport computer modeling. In the early 1960's, Mr. Saccenti participated in numerous nuclear activation and energy spectral unfolding projects in conjunction with Operation Dominic in the Pacific Proving Grounds and also the Nevada Test Site where he was, in addition, a certified project radiation monitor. He has directed numerous programs in instrumentation calibration and further developed specialized electronic instrument designs for total absorption radiation measurements, alpha spectral analyses, and liquid scintillation applications. He has developed automated data reduction techniques used in conjunction with on-line computers for rapidly processing large numbers of environmental and health physics type samples. Mr. Saccenti has been a member of the US Army RADCON Team since 1970 and has conducted numerous training sessions covering all phases of instrumentation utilization and field procedures.

Albert E. Rainis

Dr. Albert E. Rainis is a physicist at the Radiation Engineering Branch, Vulnerability/Lethality Division of the Ballistic Research Laboratory. He received his B.S. (physics) and M.S. (theoretical physics) degrees from De Paul University in 1963 and 1965 and the Ph.D. (experimental nuclear physics) degree from the Notre Dame University in 1970. As an Assistant Professor (1970-1975), Dr. Rainis carried out research in low energy nuclear physics at Oak Ridge National Laboratory and other accelerator facilities which has resulted in a number of significant publications in professional journals. As an example, he was the first researcher to identify the man-made isotope, ^{147}Dy. During his tenure as an Assistant Professor, he had also addressed the energy problem by mathematically modelling exotic energy extraction techniques such as low-grade geothermal utilization and in-situ coal liquifaction. His model for geothermal gradients is currently in use by other researchers in the field. He is presently engaged at the BRL in radiation calculations to determine and improve the survivability of US Army equipment on the nuclear battlefield. His work in this area has had high visibility within DA.

Carl Crisco, Jr.

Mr. Carl Crisco, Jr. is a chemist in the Radiation Engineering Branch, Vulnerability/Lethality Division, BRL. He received his BS degree from High Point College in 1951 and his MS degree from North Carolina State University in 1960. From 1951-1957 while in the Chemical Research and Development Laboratory, his work was on various assignments in nuclear effects research programs at the laboratory and at nuclear weapon tests. From 1960-1973 he worked on research and development efforts in radioactive waste disposal and in radioanalytical, radiation, and high-temperature chemistry. Since 1973, he has been applying methodologies used for fallout prediction and assessment of the vulnerability of military meteriel to conventional weaponry. He has been a member of the US Army RADCON Teams since their creation.

Murray A. Schmoke

Mr. Murray A. Schmoke is currently assigned to the Target Assessment Branch of the Vulnerability/Lethality Division of BRL. Mr. Schmoke received his BS degree in chemistry from Morehouse College, Atlanta, Georgia. He has done additional graduate work at the University of Maryland, Kansas State University, and the University of Delaware. He joined the Radiological Division of the Chemical and Radiological Laboratories in 1951 and has served as staff scientist and principal investigator on a number of nuclear weapons effects projects between 1951 and 1956. These included nuclear waste disposal and RW fallout decontamination. Between 1956 and 1975, his principal area of investigation was nuclear radiation shielding by structures, field fortifications and military vehicles. His work in structure shielding from residual nuclear radiation that was used to verify the work of Dr. L.V. Spencer of NBS in predicting the shielding capability of structures in a fallout field is widely referenced in the Shielding Community. His work in residual radiation shielding by military vehicles is unique in the shielding field and is widely referenced in Army field manuals. Since 1975 he has been with Target Assessment Branch of Vulnerability/Lethality Division, BRL. In this position, he has done considerable work in studying the vulnerability of military vehicles using computerized vulnerability codes. In this connection he has developed several computerized target description of military and marine vehicles essential for vulnerability studies. He is also one of the original members of the Army's RADCON Teams.

E. Michael Vogel

Mr. E. Michael Vogel is presently an electronic engineer serving as the team leader of the Vulnerability Reduction Team, Project HAVE NAME. Educational qualifications include an Associate in Technology degree from Temple University in 1963, several additional science undergraduate courses, and twelve specialized short courses in electronic instrumentation techniques, computer applications, and nuclear effects on electronics. Electronic instrumentation experience covers the period from 1961 to present and was obtained in private industry as well as 14 years of employment as a civilian with the Dept. of the Army. An extensive nuclear background was obtained by actively participating in nine nuclear weapons tests as project engineer responsible for active and passive dosimetry measurements. From 1972 to present, Mr. Vogel has been a principal leader in the Army's project HAVE NAME R&D program. He has functioned as an electronic specialist for the US Army RADCON Team and has been responsible for survey instrument calibration, operation, maintenance, and repair from 1965 to present.

John A. Morrissey

John A. Morrissey has a degree in Physics and has worked with accelerators from 1963 to 1975. He was employed first at the NDL 750 Kev Cockcroft-Walton accelerator as the accelerator physicist. His duties involved operating and maintaining the accelerator and working with other experimentalists mainly in the development and calibration of neutron detectors. In 1968, he moved to the NDL Tandem accelerator where, as the accelerator engineer and chief operator he was responsible for the accelerator operation and maintenance. These duties included the training and certification of all qualified operators of the Tandem and the compliance of the facility to radiological safety regulations. Also, he was actively involved in experiments with the physicists who worked at the Tandem facility. These experiments included Small Angle Neutron Scattering using time-of-flight measurement techniques, Coulomb Excitation, Delayed Fission, and Heavy-Ion Channeling. In 1974, he set up a small laboratory to study the sticking coefficients of fission products using a heavy ion source and 80kev accelerator. From 1975 to present, he has been assigned to a BRL special project, Project HAVE NAME. He is a member of the BRL Radiation Control Committee and has been a member of the RADCON Team for the past year.

Clifford Taylor

Mr. Clifford Taylor is an electronic technician. He received his technical training at the Baltimore Technical Institute. He is presently assigned with Project HAVE NAME, where he has conducted, assisted, and participated in the laboratory and field experimental studies with the HAVE NAME materials. He also participated in the experiments conducted with the Hawk missile system, and the Foreign equipment vulnerability studies. In 1960, he was assigned to the US Army Nuclear Defense Laboratory, Electronic Engineering Branch. He was responsible for the maintenance of a wide variety of electronic and electro-mechanical instrumentation utilized in the detection and analysis of radioactive materials. He also served as a member of an R&D field testing group which participated in several nuclear weapons tests at the Nevada and Pacific Nuclear test sites. He was responsible for the operational maintenance of all the electronic instrumentation utilized in the data collection for the group. He has served as a member of the US Army RADCON team since their creation.

Richard D. Miller

Mr. Richard D. Miller has a Bachelor of Science Degree in Physics from Wilkes College, Wilkes-Barre, PA. During military service with the Navy, Mr. Miller served as a Missile Technician involving nuclear warhead Polaris Missiles used aboard Fleet Ballistic Missile Submarines. Since 1972, Mr. Miller has been employed by the Ballistics Research Laboratory and has been the primary investigator for the study of laser induced damage (analytically and experimentally) to aircraft, aircraft components, jet engines, and missile systems. His extensive knowledge in the area of component damage has led to many requests for consultation by various military organizations. Further, he has become extremely proficient in assessing the probability of component kill by conventional weapons.

Richard A. Markland

Mr. Richard A. Markland is supervisor of Health Physics, BRL Operations Safety Division. He received his BS degree from the New Mexico Institute of Mining and Technology in 1973. After six months of post-graduate work, he came to BRL in January 1974 where he worked in the Detonation and Deflagration, Dynamics Laboratory (3DL) as a Physical Scientist. While in 3DL, he helped design and build the BRL Torch to simulate the extreme heat environment of a rail car accident involving propane tankcars. In 1977, he was transferred to his current position in the BRL Operations Safety Division. His training in Health Physics includes completion of the U.S. Army Ordnance and Chemical Center and School's three week Radiological Safety Course and the Oak Ridge Associated University's five week Health Physics course. He has been a member of the RADCON Teams for the past year.

R. Michael Schwenk

1LT R. Michael Schwenk is currently serving as R&D Coordinator, Vulnerability/Lethality Division, BRL. He received his BS degree in mechanical engineering with a nuclear specialty from Arizona State University in 1975, and an MA degree in management from Central Michigan University in 1978. His nuclear background includes experience in radiation measurement and thermoluminescent dosimetry (TLD). As a result of this background, 1LT Schwenk developed a means for neutron-gamma discrimination enabling the use of TLD's as in-core neutron flux measurement devices. His experience in nuclear weapon effects includes an extensive radiation transport and shielding background as applied to combat vehicle crew survivability. Most recently, 1LT Schwenk has pioneered a broad-based program for determining the cost-effectiveness of nuclear hardening Army materiel. He has been a member of the US Army RADCON Team since June 1978.

Richard A. Dunlop

SSG Richard A. Dunlop is an on-the-job-trainee with the RADCON Team, with principal responsibility for equipment maintenance and calibration. Additionally, he acts as the Team's supply officer and ensures that all required personnel actions are accomplished. His training has enabled him to qualify as a Radiation Monitor and it was in this position that he participated in NUWAX-79. SSG Dunlop is a high school graduate with 30 hours of college credit earned through the College Level Examination Program. He has seven years active military service with the U.S. Army as an Artillery Ballistic Meteorologist. During his time in service, he has served overseas in Viet Nam, Germany, and Korea. SSG Dunlop has been awarded an Air Medal, four Army Commendation Medals, two Good Conduct Medals, and several letters of appreciation and commendation for meritorious service and achievement.

APPENDIX D

NUWAX-79 PARTICIPATION

D.1 Background

On 12 July 1976 the Defense Nuclear Agency (DNA) prepared a memorandum for the Assistant to the Secretary of Defense (Atomic Energy) (ATSD(AE)) recommending a Joint DOD/ERDA Nuclear Weapon Accident Exercise. On 30 July 1976 ATSD(AE) requested that DNA prepare an exercise concept plan. The concept plan was approved by ATSD(AE) and on 22 Sep 1976 the Director, DNA forwarded a letter to the Commander Field Command DNA (FCDNA) tasking them to develop the concept. By early January 1978 a draft of the Joint Department of Defense/Department of Energy Exercise Plan Nuclear Weapons Accident Exercise - 79 was distributed to the Services and DOE for coordination and comment. The coordinated and approved plan was distributed on 30 June 1978. The plan called for a Nuclear Weapons Accident Exercise (NUWAX-79) to take place between 2 April and 23 April 1979.

The objective of NUWAX-79 was to exercise the deployment of accident response forces of the Services and DOE to a distant and remote "Field Location" and to test/evaluate selected response and coordination procedures during a simulated accident which results in the burning and high explosive dispersal of nuclear weapons (radioactive) material.

The broad objectives of the exercise were:

1) To provide a realistic training vehicle for DOD and DOE nuclear accident response organizations.

2) To determine the effectiveness of the nuclear accident response equipment, procedures, techniques, directives, and plans of DOD and DOE.

3) To determine the effectiveness of an interservice change-of-command and the coordination and communications of a multi-Service and DOE accident response force.

The exercise scenario involved a USAF C-141 aircraft, with six nuclear weapons on board, that was enroute from the Pacific area to California and New Mexico. However, because of adverse coastal weather conditions, the aircraft was diverted and enroute to the alternate destination the C-141 experienced severe in-flight malfunctions and crashed in open terrain. The C-141 broke up and burned. Three of the nuclear weapons on board were destroyed by the fire and resultant HE explosions. The three remaining weapons (one from each Service) were damaged. The aircraft crew members were killed/injured and contaminated. Notification of the accident emanated from the aircraft and local personnel on the ground. The nearest military installation was notified and a simulated "Broken Arrow" message was submitted to the National Military Command Center (NMCC). Headquarters, DOE and the Joint Nuclear Accident Coordinating Center (JNACC) were notified. Subsequently the nuclear accident response organizations of the Services and DOE were notified.

The exercise was based on a DOD nuclear weapons accident (simulated), which poses a radiological hazard (simulated) to civilian life and property within an area in CONUS. The accident was designed to be a Category II incident, which is described by the Federal Preparedness Agency (FPA) in the Federal Response Plan for Peacetime Nuclear Emergencies (FRPPNE) as a transportation accident involving radioactive materials, with the potential for widespread contamination.

The scenario involved radioactive contamination and damage to weapons belonging to the three Services which were designed by both nuclear weapon design laboratories: Lawrence Livermore Laboratory (LLL), and the Los Alamos Scientific Laboratory (LASL). This mix of weapons allowed the exercise of Render Save Procedures (RSP) and disposal procedures by the appropriate Service Explosive Ordnance Disposal (EOD) units and design Laboratories' weapon specialists.

It was necessary to preposition the Army Nuclear Accident/Incident Control (NAIC) team prior to the start of the exercise in order to conform to the preexercise situation. This movement was directed toward achieving realism in the play and permitted the exercise of passage of command and control from one Service to another.

The exercise was conducted on Federal property (but simulated private property) due to political, public affairs, economic, and security considerations. The following sections describe, in detail, the actions of the two RADCON Teams in connection with NUWAX-79.

D.2 Team 1 NUWAX Activities

D.2.1 Pre-deployment

Although part of the NUWAX objective was to test the response of the various elements, the exact date of D-day was common knowledge, known considerably in advance of the exercise. The team leader was even required to submit a Special Assignment Airlift Mission (SAAM) request 60 days in advance. On D-day, 18 April 1979, the pilot of an Air Force C-141 called and stated that he was landing at Andrews Air Force Base (AAFB) at 0900 19 April 1979, but that Military Airlift Command (MAC) wanted our nine man team there for processing at 0700.

Team 2 planned to deploy on 20 April 1979 by commercial air and replace Team 1 on 21 or 22 April. If this became operationally unfeasable, an exercise at Area 13, Nevada Test Site (NTS) was provisionally scheduled on 23 April 1979.

Two augmentation Team 1 members, Mr. Kinch and LT Schwenk traveled to Nevada to check out our instrumentation trailer which was prepositioned at Mercury (NTS), and to logistically support the team movement from the airhead, Nellis AFB (NAFB) to the accident site at the former nuclear reactor test center at NTS, near Lathrop Wells, Nevada.

D.2.2 Deployment

The team was never notified by the established procedure, i.e., a call or TWX from DARCOM or JNACC, but was well aware of the movement as stated previously. Arrangements were made to have a commercial bus available at Bldg E5695, APG-EA at 0400 19 April 1979 for loading 14 instrument cases, 3 foot lockers, and nine men with personal baggage. Departure was at 0430 with arrival at AAFB at 0630. Members present were Mr. Maloney, Mr. McNeilly, Mr. Kammerer, Dr. Quigley, Mr. Schmoke, Mr. Morrissey, Mr. Miller, Mr. Vogel and Dr. Klopcic.

The team was joined at 0700 by the six member RAMT from Walter Reed Medical Center. The SAAM flight arrived at 1000 but refueling and loading were not accomplished until 1200. Arrival at NAFB was 1400. There was considerable press coverage of the arrival, but no team members were interviewed.

The C-141 was expeditiously unloaded by the crew and gear and baggage were deposited at the edge of the apron, whereupon all Air Force personnel disappeared, leaving the RADCON and RAMT personnel stranded. The importance of pre-planning became very apparent as Mr. Kinch and LT Schwenk arrived with a rental sedan. Two pickup trucks were also supplied by the Air Force. Three Team members proceeded with Mr. Kinch to a commercial car rental location for three more sedans. By 1630, the 11 men 4 sedans, and 2 pickup trucks were loaded and proceeded by convoy to the accident site, arriving at NTS Gate 510 at 1830.

Although all clearances had been previously submitted six weeks in advance, the DOE badge officer had no CNWDI access for the team, but badges were issued to permit travel to the base camp. Arrival at the base camp "Harvest Eagle" was at 1900.

The team leader reported to Air Force COL Maurice L. Grimaud, representative to the Army On-Scene Commander (OSC). Advice was given that the OSC would be replaced by Air Force BG Gardner at 0200 20 April 1979, and to report to him in the morning. The team was immediately assigned to quarters (tent) but some problems were encountered in obtaining bedding. Sleeping bags and cots were eventually obtained.

D.2.3 Site Operations

At 0700 20 April 1979 the team leader again met COL Grimaud and was referred to Mr. Curtis Hayden of his operations staff. Mr. Hayden informed the team leaders that at that time no monitoring had been accomplished closer that 500 metres to the crash site, that the hot line was about 1000 metres from the crash, and EOD render-safe had not been completed. The team utilized the available time to check out instrumentation and take a one hour background air sample. By the time the CNWDI clearance problem was straightened out, it was late afternoon. The team leader and assistant team leader briefed Mr. Hayden and Mr. Hull of OSC

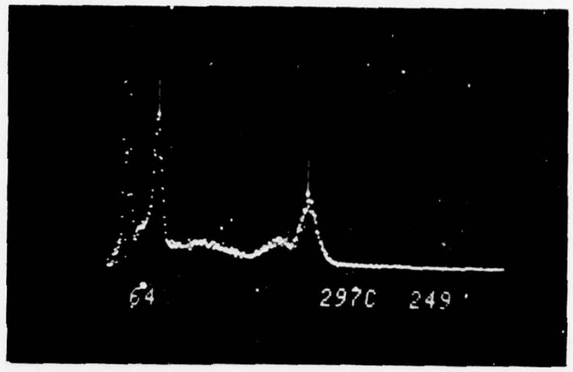
operations about team capabilities. There were no requirements for team operations at the crash site which had still not been rendered safe by the EOD.

At 0700 21 April 1979 the team reported to Mr. Hayden at the hot line. However the EOD problem had still not been rectified. One hour air samples were taken 100 feet upwind of the hot line area boundary and at the personnel monitoring area. The filters from the Staplex samplers read ∿1000 cpm with the PAC-1SGA radiac (hereafter called the AN/PDR-60 which is the military equivalent), and which decayed to background within four hours. The same reading had been obtained on 20 April 1979 at the base camp. At 1330 the team was requested to monitor some traffic cones at a remote roadblock. No contamination was detected. At the request of Mr. Hayden, the entire hot line area was monitored for contamination, and none was detected. For all monitoring operations, the AN/PDR-60, E-520, and FIDLER radiacs were used.

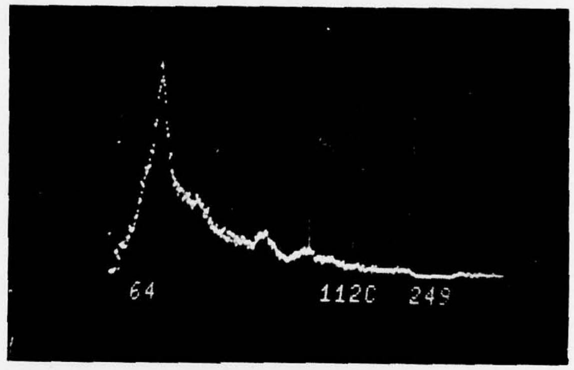
Our air sampling operations created much interest, especially when the OSC became aware of it. Unknown to us, there existed an environmental engineering group within his staff but they had no operable air samplers or power sources. By request of COL Grimaud, 1LT Schwenk was taken to the official observer area where a one hour air sample was taken and counted. At 1100 COL Grimaud formally requested that all air sampling equipment that was not absolutely essential to RADCON operations be made available to his staff. One generator and one Staplex sampler were rebased.

At 1400 the crash site was adminstratively declared EOD safe. COL Grimaud on behalf of the OSC requested that an exploratory survey be made of the area between the hot line and the aircraft wreckage, with the objective of moving the hot line in closer. Mr. McNeilly, Mr. Morrissey, and Dr. Quigley proceeded along a previously graded trail at 82^{o} toward the wreckage. Radio contact was maintained with this party. The first sign of radioactivity was detected (using the FIDLER) 200 feet West of the wreckage. Readings rose from zero to 100 cpm on the AN/PDR-60 within a lateral distance of three feet, and slowly rose to 300 cpm at the wreckage. There was no response on the E-520. Request was made for a soil sample, and Mr. Vogel readied the CANBERRA Model 8100 1024 channel gamma pulse height analyzer, with FIDLER probe, and our spare generator for power. COL Grimaud requested the survey party to withdraw 100 yards to the west of the background limit, and monitor and stake a 150 x 150 yard area bisected by the trail, for a relocated hot line. This was accomplished by 1440, and the OSC promptly ordered the hot line moved to that location. The soil sample was delivered to Mr. Vogel, who verified that it was ^{223}Ra (see Figure D-1).

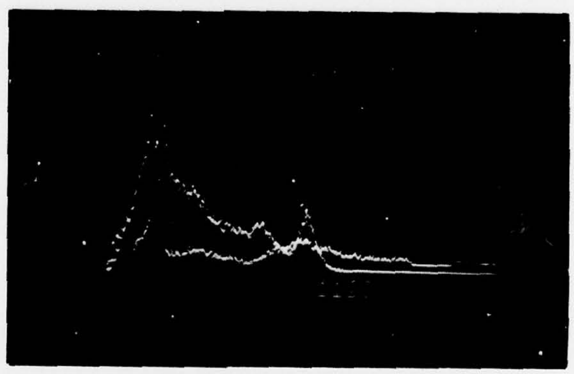
At 1500 two survey parties consisting of Mr. Schmoke/Mr. Morrissey/Dr. Klopcic and Mr. Kinch/Mr. Miller/1LT Schwenk were dispatched to stake the limit of background and 100 cpm (AN/PDR-60) isocon lines at 30^{o} azimuth intervals (see Figure D-2). The only problem encountered was radio transmission failure.



Ba^{133} standard

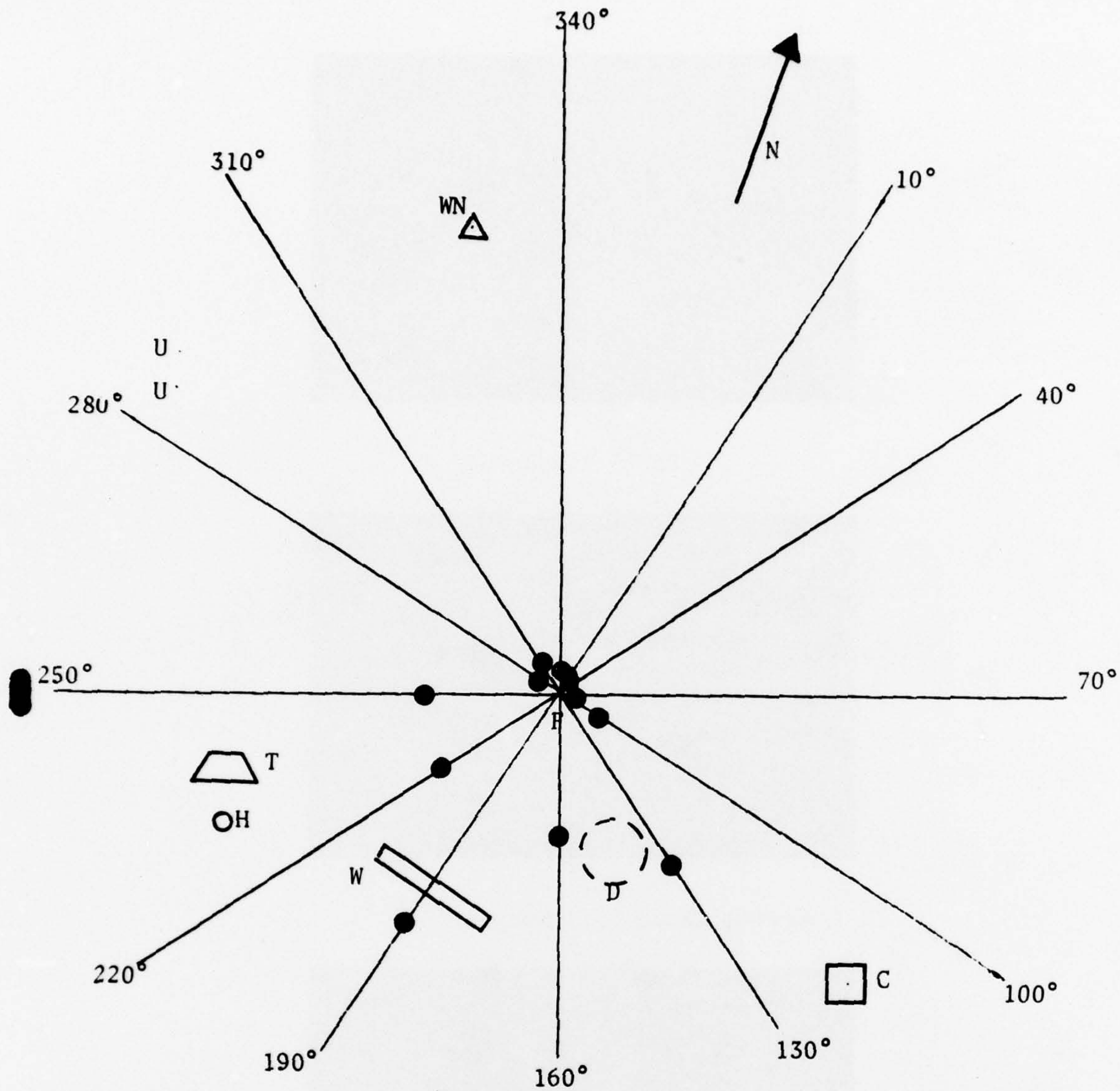


Contaminated Soil Sample (Ra^{223})



Standard Ba^{133} overlayed on Soil Sample

Figure D-1. Contamination and Standard Spectra.



Scale 1 cm = 50 ft

C Cockpit
D Debris
F Fuselage
W Wing
Recommended Hot Line

H Hole
T Tail
U Uranium Pieces

WN Weapon
Flags at Contamination Demarcation

Figure D-2. RADCON TEAM Survey - 20 April 1979.

During the period that the OSC was having the hot line area moved, a returning contaminated EOD party traversed the trail. They were sent to the relocated hot line, while at the request of COL Grimaud, Mr. Vogel surveyed the trail with a FIDLER to confirm that it had not become contaminated.

At 1730, using the RADCON Team scenario, COL Grimaud was informed that all team personnel were administratively at their exposure limit, but that another RADCON Team was available in the area for replacement. It was recommended that the present personnel be released, and that replacements would be on hand at 0700 22 April 1979 with the Team 1 leader present for continuity as long as required. Concurrence was granted with the provision that the team leader and assistant make a survey plot and ^{223}Ra identification data available at a 1930 NUWAX staff briefing.

An exodus of personnel began at 1900 and was complete by 2030.

D.3 Team 2 NUWAX Activities

D.3.1 Deployment

Team two journeyed by rental cars to Washington National Airport in the early morning of 20 April, departed at 0710 hours and arrived at Las Vegas at 1012 hours. The Team secured rental cars and checked into a motel and obtained badges for the NUWAX exercise at the Nevada Operations Office of the Department of Energy. During the day and evening of 20 and 21 April, a Team 2 command post was set up in one of the motel rooms and the telephone constantly manned to receive any telephone calls from Team 1. Also on 21 April Team 2 members went to the RADCON Team trailer at Mercury and checked out several pieces of equipment for proper operation.

At 2130 hours on 21 April, Team 2 members were called to the command post. Mr. McNeilly along with other Team 1 members briefed Team two at 2230 hours. After the briefing, which lasted about one hour, Team 2 made preparations for the next day's exercise before retiring.

D.3.2 Site Operations

Team 2 left the motel on 22 April, at about 0500 hrs. and arrived at the exercise site at 0700 hrs. Confusion about our badge status caused some delay in getting started at the exercise.

The Team 1 leader (Mr. Maloney) was present until 1200 hrs. to ensure a smooth transition of responsibilities from Team 1 to Team 2. A 30 minute air sample was taken at the base camp area and no radioactivity was detected.

After the Team 2 leaders received their assignments, a four man party, Saccenti/Markland/Evans/Crisco, was dispatched to survey an area designated by the OSC. The party dressed out in protective gear and proceeded after considerable delay through security check-point and Rad-Safe check-point. The group took 1 FIDLER, 1 E520, 1 PAC-1SA and appropriate peripheral equipment. At 1000 hours they proceeded by pickup truck to a point as close as possible to the area to be surveyed. The party proceeded on foot to a starting point (SP) marked previously by a Navy Survey Team.

The party leader (Saccenti) decided to first survey along an axis from the SP toward the fuselage wreckage. FIDLER readings were taken along the axis and at paced off intervals. PAC-1SA ground readings were also made. Next, a 45^o in-and-out survey was performed using the FIDLER for locating hot spots and then taking quantitative readings with the PAC-1SA. After the first 45^o leg this approach was more or less abandoned and the group proceeded to use the FIDLER to locate the perimeter and then used the PAC-1SA to locate the 300 cpm points. After locating one side of the perimeter, a line was surveyed perpendicular to the first axis in order to establish the width of the contaminated area. Then using the points on the original axis, the 300 cpm points perpendicular to the axis line were located. This procedure was continued until data were accumulated to generally outline the contaminated area. All distances were obtained by pacing. The party returned to the hot line and were monitored out at 1330 hrs. No contamination was found on personnel. All instruments, badges, and other equipment had to be left at the hot line for monitoring and decontamination.

At 1200 hrs. a second party consisting of Jacobson/Dunlop/Rainis/Taylor/Wilsey "suited up" in one layer of coveralls, head coverings, and gloves, two layers of booties and used Army M17A1 gas masks as respirators. Their assignment was to survey the southwest quadrant of the contaminated site. A base line was set up by walking west from the point at the wreckage which was considered to be the closest point to "ground zero". Red flags attached to dowels were hammered into the ground every twenty feet up to 400 feet from the starting point. A bearing was taken with the compass to establish a line perpendicular to the base line and one of the members (Dunlop) paced out to a distance of 400 feet from the starting point on that bearing. FIDLER readings were taken every 20 feet on that radial. Two other members of the party took similar readings on a parallel line which was 20 feet away. Following this manner, adjacent parallel lines were surveyed with the FIDLER until a 400 ft x 400 ft grid was established. A correlation survey using the PAC-1SA was begun but could not be completed because of instrument malfunction. After completion of the grid survey, FIDLER readings were taken at several pieces of the wreckage and the Team then exited the contaminated area through the hot line check point.

On the second day the same two parties, were utilized. Jacobson's party surveyed the quadrant southeast of the zero point. The base line

was set up in the same manner as on the previous day and a grid survey was conducted. However, using the now repaired PAC-1SA alpha survey meter, measurements were made at every base line marker and at most locations where the FIDLER reading was in excess of 50,000 counts per minute. The party also surveyed some more of the major wreckage with the FIDLER and the PAC-1SA where appropriate. The survey was conducted from 1000 to 1300 hours.

In the meantime Saccenti's party was requested to conduct a survey of an area which an aerial survey had identified as being contaminated. Using a compass, the survey was conducted along a line with the bearing being supplied by the OSC. No contamination was located until a group of ten radioactively marked 55 gal drums were found. A careful survey around the drums, located no other contamination. The distance from drums at which background FIDLER readings were obtained was located. PAC-1SA readings in the area were less than 300 cpm. The Team then returned to area where the Jacobson party was surveying and proceeded to make correlation readings between the FIDLER and the PAC-1SA in an area where, on the previous day, the PAC-1SA's had failed. The party then returned to the hot line and were surveyed out at approximately 1200. Team was released by the OSC at 1330 hours and left the exercise area.

D.4 Critique

The critique of NUWAX-79 is in two parts. Part 1 addresses ideas/ criticisms/ recommendations concerning the NUWAX operations and Part 2 is a critique of the RADCON Teams operations by Team members.

D.4.1 NUWAX-79 Operations

The initial criticism of the NUWAX-79 operations was that the US Army RADCON Teams never directly received an official notification of the alert and it was only through the close coordination with the Walter Reed RAMT Team that notification was obtained. Also, of course, the requirement of scheduling the military airlift pinpointed the day of the event. Nevertheless, the fact remains that no official notification of the alert was received by the RADCON Teams. The arrangements for the military airlift left much to be desired. At least 5 hours of totally unproductive waiting time was spent in the terminal waiting for the aircraft. Military vehicles which had been previously arranged for, were not immediately available at Nellis AFB. By the time the RADCON Team arrived at the NUWAX site, processed through security (where the inappropriate badges were acquired), and settled into the base camp, most of the team members had been in transit for nearly 20 hours.

Once on-site and contact with the On Scene Commander (OSC) was made it was very apparent that he and his staff had no idea what the Army RADCON Team was or what their mission and capabilities were. It was only through continual contact with OSC's staff that we were finally employed in the exercise. It was evident that many of the individuals

on the OSC's staff were completely inexperienced in such emergency operations and had no concept about the radiological aspects of the operation.

The procedures used at the hot line for clearing the players into the area were, at best cumbersome. The excess time required for these procedures added to the discomfort that accompanies being dressed up in full RADEX ANTI-C clothing for several hours.

It was felt that the OSC staff were driven or distracted unnecessarily by the controllers and/or umpires. Perhaps the controlling and/or umpiring could have been better accomplished from a distant vantage point rather than mingling with the players and OSC staff.

It was also noted that several individuals wearing ANTI-C clothing were at the base camp and even in the messing facilities. This practice should be discouraged - ANTI-C clothing is for contaminated areas, not living areas.

On the other hand if the exercise had not been conducted, it is doubtful that the above mentioned problems would have ever come to light. Further, the exercise created an ideal forum for the interaction of the various DOD and DOE response teams and as such, created a heretofore unavailable, awareness of procedures and techniques that are employed by such teams. It is felt that this awareness will lead to a number of fruitful future cooperative endeavors. Thus, with all of the problems and, in some cases, actual inabilities, the NUWAX-79 exercise must be judged a complete success.

Although this section of the report was primarily intended to make the reader aware of RADCON Team activities, the NUWAX-79 exercise allowed us to observe the ability of the DOD and DOE to respond to a major emergency situation. One fact became painfully clear, and that involved the abilities of the various On-Scene Commanders and their staffs. There is no doubt that these people are dedicated hard working individuals. However, it is similarly obvious that their talents and abilities were limited in this highly specialized area. Consequently it is recommended that the DOE/DOD seriously consider the creation of a permanent cadre of experts who would be called upon to function as the OSC's staff in case of an accident/incident. Such a cadre could consist of 10-12 individuals who have considerable experience is such areas as radiation detection and measurement (in the field), health physics, hazardous material handling, decontamination, nuclear instrumentation, nuclear weapon design, etc. Such people are certainly available within the DOE/DOD and could be organized to respond to a major incident. Further, such a cadre could act in an advisory capacity relative to assessing the capabilities of the various emergency response teams and recommending specific training, equipment and field exercises to ensure their operational readiness. Although this is a somewhat radical departure from the present method of operation, it is certain that a major improvement

in our overall response capability could be made with minimum effort and expense.

A last recommendation involves the problem with clearances and badging. It is suggested that a permanent universal special badge be issued to all emergency response team members which could be used at incident/accident sites. Further, records of such badges, clearances, etc might be centralized at a site such as JNAC. Updates to these centralized records would be required as necessary.

It is in a spirit of constructive criticism that the above recommendations have been made.

D.4.2 RADCON Team

Criticisms of the RADCON Teams concerning their operations were centered primarily on instrumentation and communications. Much difficulty was experienced with AN/PDR-60's with their extremely fragile windows under such adverse conditions. The probe faces were continually being punctured. It is recommended that a protective screen (available commercially) be installed to reduce such punctures. The screen would reduce the sensitivity of the instrument from 31% to 20%, however in a serious contamination event this loss of sensitivity is of little consequence.

The RADCON Team radios were completely unreliable. During most of the first day's operation the monitoring teams were completely out of touch with the hot line. Reliable replacement radios are being purchased.

The handling of the instruments, radios, data recording, and stakes within the contaminated area while in full ANTI-C clothing posed several problems. There is a large amount of material to be handled by individuals, and devices such as straps, bags, and belts should be employed to assist in efficiently and effectively using the various items. Also, a way should be devised so that the recorded data can be recovered even if the clipboard becomes contaminated.

It was also noted that the age of a number of the RADCON Team members is to the point that the performance of physical labor while dressed in ANTI-C clothing in hot weather, is extremely strenuous and their efficiency is rapidly reduced. The addition of younger members to the teams would be welcome.

It should be noted that with exception of the above mentioned problem areas it is felt that the Army RADCON Teams functioned in an extremely efficient and effective manor. There is no doubt that the extensive training which is conducted and the dedication of the team members were responsible for its performance. On the other hand it is also just as obvious that continued training and constant upgrading of equipment will be necessary to enable the teams to remain at the required readiness level.

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Please take a few minutes to answer the questions below; tear out this sheet and return it to Director, US Army Ballistic Research Laboratory, ARRADCOM, ATTN: DRDAR-TSB, Aberdeen Proving Ground, Maryland 21005. Your comments will provide us with information for improving future reports.

1. BRL Report Number ______________________________

2. Does this report satisfy a need? (Comment on purpose, related project, or other area of interest for which report will be used.)

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3. How, specifically, is the report being used? (Information source, design data or procedure, management procedure, source of ideas, etc.) ______________________________

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4. Has the information in this report led to any quantitative savings as far as man-hours/contract dollars saved, operating costs avoided, efficiencies achieved, etc.? If so, please elaborate.

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5. General Comments (Indicate what you think should be changed to make this report and future reports of this type more responsive to your needs, more usable, improve readability, etc.) __________

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6. If you would like to be contacted by the personnel who prepared this report to raise specific questions or discuss the topic, please fill in the following information.

Name: ______________________________

Telephone Number: ______________________________

Organization Address: ______________________________

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